5-3805-255-14+P



TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

# LOADER, SCOOP TYPE, DED, 4 x 4, ARTICULATED FRAME STEER, $4^1/_2$ to 5 CU. YD., (CCE) (IHC MODEL H100C):

# TYPE I WITH $4^1/_2$ CU. YD. BUCKET

NSN 3805-01-052-9042

# TYPE II WITH 5 CU. YD. GENERAL PURPOSE BUCKET

NSN 3805-01-052-9043

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 1980

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CHANGE
NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *3 November 1986*

# TECHNICAL MANUAL

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## AND GENERAL SUPPORT MAINTENANCE MANUAL

## (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

## LOADER, SCOOP TYPE, DED, 4 x 4,

## ARTICULATED FRAME STEER, 4 1/2 TO 5 CU. YD., (CCE)

## ARMY MODEL H100C RB

## TYPE I WITH 4 1/2 CU. YD. ROCK BUCKET

## NSN 3805-01-052-9042

## ARMY MODEL H100C GPB

## TYPE II WITH 5 CU. YD. GENERAL PURPOSE BUCKET

## NSN 3805-01-052-9043

TM 5-3805-255-14&P, 15 July 1980, is changed as follows:

1. The Parts List Portion of this manual has been replaced by TM 5-3805-255-20P, Organizational Maintenance Repair Parts and Special Tools Lists and TM 5-3805-255-34P, Direct Support and General Support Maintenance Repair Parts and Special Tools Lists.

2. Remove old pages and insert new pages as indicated below.

| *Remove Pages* | *Insert Pages* |
|---|---|
| Pages C-1 through C-13 APPENDIX C | Pages C-1 through C-16 APPENDIX C |

3. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
*General, United States Army*
*Chief of Staff*

Official:

R.L. DILWORTH
*Brigadier General, United States Army*
*The Adjutant General*

Distribution:

To be distributed in accordance with DA Form 12-25A, Operator, Organizational, and Direct and General Support Maintenance requirements for Scoop Loader, Diesel, 4x4, Type I, 4½ cu. yd., Bucket, Type II, 5 cu. yd., Bucket, Model H100C.

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TECHNICAL MANUAL

TM 5-3805-255-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 July 1980

# OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

LOADER, SCOOP TYPE, DED, 4 X 4
ARTICULATED FRAME STEER, 4 1/2 to 5 CU. YD., (CCE) (IHC MODEL H100C):

TYPE I WITH 4 1/2 CU. YD. BUCKET

(NSN 3805-01-052-9042)

TYPE II WITH 5 CU. YD. GENERAL PURPOSE BUCKET

(NSN 3805-01-052-9043)

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

# SECTION INDEX

This manual covers the instructions for operation, lubrication, adjustments and maintenance for normal daily care. These instructions are divided into nine sections to simplify your reference to the information most important to you. Refer to Table of Contents on next page for a complete list of the subjects covered within each section.

*This manual has been prepared to help you operate and maintain your machine with utmost efficiency and safety. Read this manual thoroughly and learn your machine before you attempt to operate it.*

**SECTION 1 — INTRODUCTION**

This section discusses generally the use of this manual, serial numbers and how to ship or store this machine.

**SECTION 2 — BEFORE STARTING THE NEW MACHINE**

This section outlines the special procedures necessary to insure proper "break-in" and care of a new machine.

**SECTION 3 — INSTRUMENTS AND CONTROLS**

The text and illustrations on instruments and controls in this section are designed to tell you "where it is," "what it does," and "how to use it." Read this section carefully.

**SECTION 4 — PREPARING FOR EACH DAY'S WORK**

This illustrates the few simple preparations *before* each day's work to assure a work day free of "down time."

**SECTION 5 — OPERATING THE MACHINE**

This section outlines and illustrates the step-by-step procedures for starting, operating, and stopping the machine.

**SECTION 6 — OPERATING TECHNIQUES**

A few operating suggestions and techniques are discussed with simple ideas to help ease the work and lengthen the useful life of your machine.

**SECTION 7 — SCHEDULED MAINTENANCE**

A complete scheduled maintenance procedure is outlined here — one that assures less down-time and expense, and more profit and work from your machine. Read and use this section.

**SECTION 8 — MAINTENANCE**

Many of the maintenance and adjustment procedures outlined in Section 7 need clear explanation. This section is devoted to explaining the "how to do" in an easy style to help you "do it yourself" and get it right.

**SECTION 9 — SPECIFICATIONS AND CAPACITIES**

This section covers the capacities, general dimensions and weights, speeds and torques.

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# INTRODUCTION

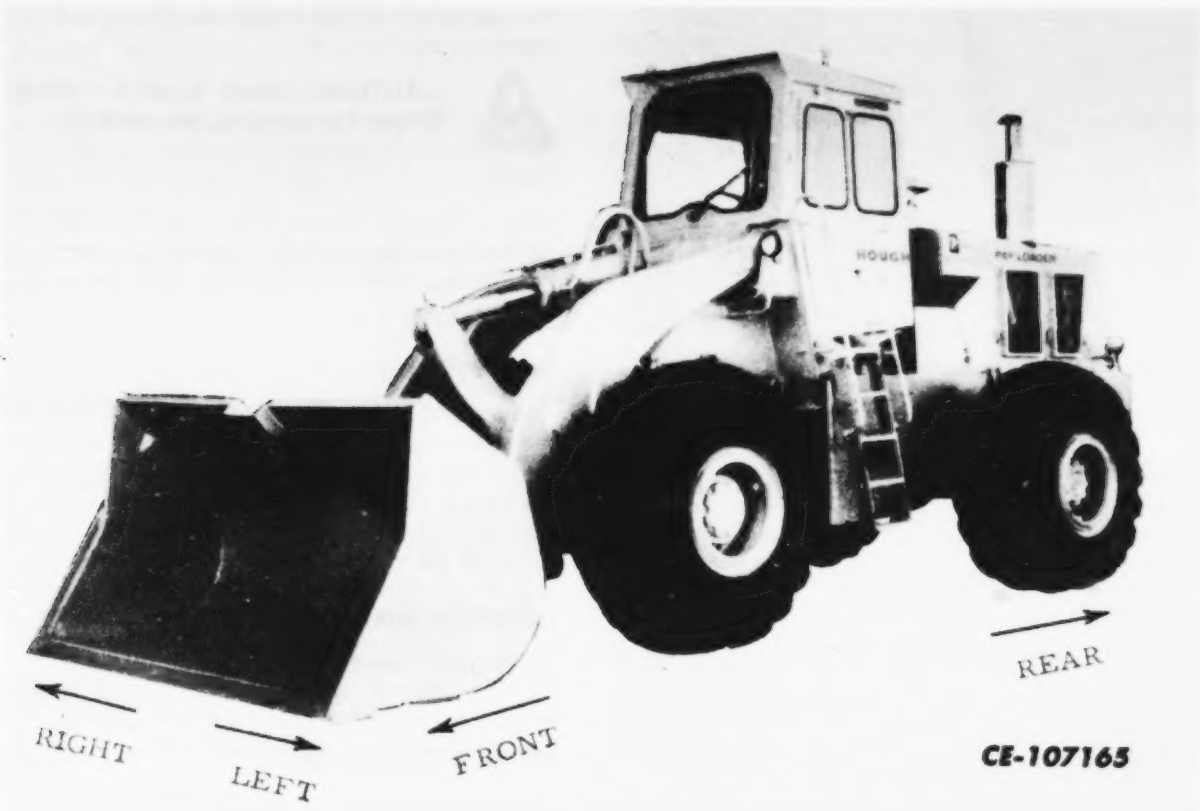



**Fig. 1. Model H-100C Pay loader**

## GENERAL

Any cross references in this manual are to a specific section of the manual.

Some illustrations are of general application of this model and may not show your equipment accurately in all details.

Throughout this manual the use of the terms "left," "right," "front," and "rear" must be understood to avoid confusion when following instructions. "Left" and "right" indicate the left and right sides of the tractor when facing forward in the operator's seat (see Fig. 1).

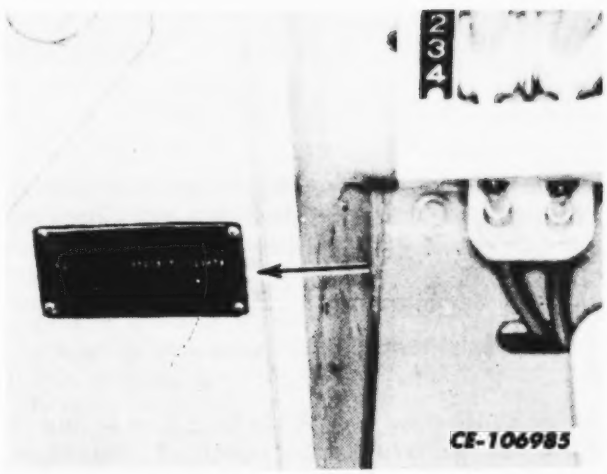



**Fig. 2. Machine Serial Number Plate**

## SERIAL NUMBERS

The machine serial number plate (Fig. 2) is located on the lower left hand side of the operator's compartment. This serial number is also stamped on the left rear side of the rear frame (Fig. 3).

The engine serial number is located on the left side of the engine block near the flywheel housing (Fig. 4). It is stamped into the engine block.

# INTRODUCTION

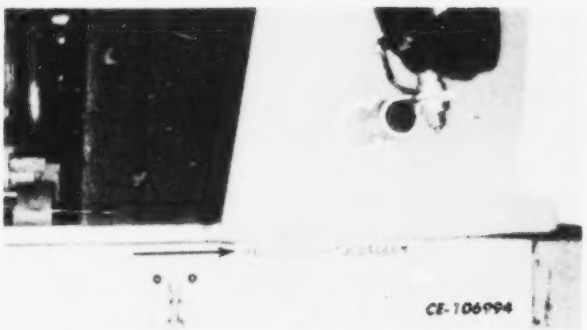



**Fig. 3. Machine Serial Number Location on Rear Frame**

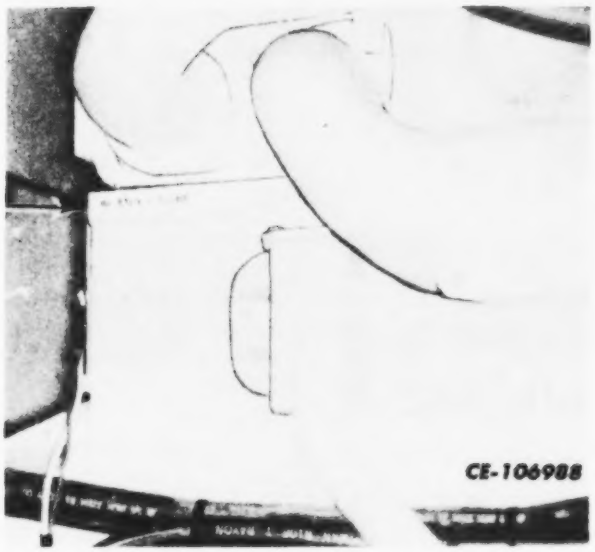



**Fig. 4. Engine Serial Number**

Use serial numbers when requesting information or ordering parts. For ready reference, write these serial numbers in the spaces provided below.

Machine Serial Number _____

Engine Serial Number _____

## MACHINE TRANSPORT

### SHIPPING INSTRUCTIONS

**NOTE:** *When transporting this machine on a high speed carrier, seal the intake and exhaust pipe openings to prevent turbocharger damage.*

The electrical system master switch must be in the "OFF" position.

**CAUTION! Always install the safety bar before transporting the machine.**

#### Truck

When shipping this loader by truck, the state and local regulations may vary. Contact the state and/or local authorities for the proper shipping and loading regulations.

#### Railroad Flatcar

The loading rules and specifications published by the Association of American Railroads must be followed when shipping this machine on open top railroad cars. Check the manual entitled "Rules Governing the Loading of Commodities on Open Top Cars" at the nearest Railroad Freight Agency.

### MOVING A DISABLED MACHINE

Towing this machine is not recommended.

## MACHINE STORAGE

### PREPARING FOR STORAGE

When the machine is not to be used for a period of time, store it in a dry and protected place. Leaving equipment outdoors exposed to the elements will materially shorten its life.

Follow the procedure below when the loader is placed in storage for 30 days or more. Lubricate the machine every six months.

1. Wash or clean the machine thoroughly.

2. Lubricate all points of the machine as outlined in the "SERVICE GUIDE" in Section 7.

3. Move the machine to storage location.

4. If the cooling system will be exposed to freezing temperature and water only was used during operation, drain and refill the cooling system with an antifreeze solution. Refer to "COOLING SYSTEM" in Section 8.

5. Remove the injection nozzles. Spray 28 grams (one liquid ounce) of Grade 30 lubricating oil into each cylinder. Crank the engine two or three revolutions. Clean the nozzle seats and install the injection nozzles with new gaskets.

6. Service the air cleaner. Refer to "AIR CLEANING SYSTEM" in Section 8.

7. Drain the water from the fuel tank and fill with approved diesel fuel. Refer to "FUEL SYSTEM" in Section 8.

8. Seal the engine air intake, exhaust outlet, electrical components, fuel tank vent line and breathers on the crankcase and hydraulic reservoir to prevent dirt and moisture from entering.

9. Remove the batteries and store them in a cool dry place (0 to 10°C/32 to 50°F) to minimize self-discharge. Be sure the batteries are fully charged. Check batteries once a month for water level and specific gravity. Never allow batteries to run down below 3/4 full charge.

10. Coat all machined, unpainted surfaces with chassis grease to prevent rust.

11. Oil all connections, joints, nuts, pins shaft and bushings of the control linkage which are not provided with a lubrication fitting.

12. If the bucket is detached for storage, secure the cylinder to the machine to avoid damage.

13. If it is desirable to leave the tires on the machine, jack the machine up and place it on blocks leaving the tires in suspension. Deflate and cover the tires.

## SERVICING ENGINE DURING STORAGE

### One-Month Repetitive Service Period

1. Remove the coverings from the engine crankcase breather tube, exhaust outlet, electrical components, fuel tank vent line and engine air intake. Install the air intake cap.

2. Check the cooling system for leaks, loose connections and proper coolant level. Refer to "COOLING SYSTEM" in Section 8.

3. Check the engine oil level and add appropriate oil as required. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES" in Section 7.

4. Drain the water from the fuel tank. Refer to "FUEL SYSTEM" in Section 8.

5. Install fully charged batteries. Refer to "ELECTRICAL SYSTEM" in Section 8.

6. With the engine shut-down handle pulled out and the electrical system master switch in the "ON" position, crank the engine until an oil pressure reading is indicated on the engine oil pressure gauge.

**NOTE:** *Cranking the engine should be limited to 30 second intervals as outlined under "STARTING THE ENGINE" in Section 5.*

7. Start the engine and run at low to medium speeds for 20 minutes and then shut down.

8. Remove the air intake cap. Seal the engine crankcase breather tube, exhaust outlet, electrical components, fuel tank vent line and engine air intake.

9. If the machine has been stored for a period of one year:

a. The fuel system must be completely drained and refilled with approved diesel fuel. Fuel filters must also be changed.

b. The engine oil must be drained and replaced with recommended lubricating oil. Oil filters must also be replaced.

### Six-Month Repetitive Service Period

1. Perform Steps 1 through 5 of the "One-Month Repetitive Service Period".

2. Spray the inside of the crankcase through the oil filler pipe with 15 ml (0.5 oz) of volatile corrosion inhibitor oil for each litre or quart of engine lube oil capacity.

**NOTE:** *Volatile corrosion inhibitor oil such as MOTORSTOR (order from Delbert Chemical, 709 Enterprise Drive, Oak Brook, Illinois 60521), or equivalent, is available. Due to a relatively small amount of volatile substance in MOTORSTOR, irritation of eyes may occur and prolonged exposure to the vapors should be avoided.*

3. Through a tapped hole in the intake manifold, spray 60 to 120 ml (2 to 4 oz) of "VCI" into the air induction system.

4. With the engine shut-down handle pulled out and the electrical system master switch in the "ON" position, crank the engine for 5 to 10 seconds.

5. Remove the air intake cap. Immediately seal the engine crankcase breather tube, exhaust outlet, electrical components, fuel tank vent line and engine air intake.

6. Add 74 ml (2.5 oz) of "VCI" for each gallon of fuel in the tanks. An option to this is to completely drain the fuel tanks and spray the inside of the tanks with 40 ml (1-1/3 oz) of "VCI" for each 38 litres (10 gallons) of tank capacity.

7. If the machine has been stored for a period of one year, the following additional service must be performed prior to repeating the "Six-Month Repetitive Service Period" procedure above:

# INTRODUCTION

a. If fuel is left in the tank, the fuel system must be completely drained and refilled with approved diesel fuel; or if left empty, the inside of the tanks must be sprayed with "VCI" as previously described.

b. The engine oil must be drained and replaced with recommended lubricating oil.

## PREPARING FOR OPERATION

1. Remove grease from all machined unpainted surfaces.

2. Install fully charged batteries. Refer to "ELECTRICAL SYSTEM" in Section 8.

3. Remove coverings from engine air intake, exhaust outlet, electrical components, fuel tank vent line, and breathers on the crankcase and hydraulic reservoir.

4. Drain the old fuel from the fuel tank and fill with an approved diesel fuel. Refer to "FUEL SYSTEM" in Section 8.

5. Check the cooling system for leaks, loose connections and coolant level. Refer to "COOLING SYSTEM" in Section 8.

6. Service the engine as follows:

a. Drain the crankcase oil, change lubricating oil filters and fill with the specified lubricating oil. Refer to "ENGINE LUBRICATING OIL FILTERS" in Section 8.

b. Prime the turbocharger. Refer to "TURBOCHARGER" in Section 8.

**CAUTION! Before starting the engine, be sure the area is adequately ventilated to avoid danger from exhaust gas. Do not accelerate the engine rapidly or operate it at high speed immediately after starting.**

c. Start the engine and run at low idle a few minutes to allow thorough distribution of lubricating oil. Do not place the machine under load until normal air pressure and temperature are reached.

d. If the engine is misfiring or loss of power is evident the fuel system is possibly clogged. Refer to "FUEL SYSTEM" in Section 8.

## INITIAL SERVICE PROCEDURE

1. Check the belt tension. Refer to "BELTS" in Section 8.

2. Check coolant level. Refer to "COOLING SYSTEM" in Section 8.

3. Check the battery liquid level. Refer to the "ELECTRICAL SYSTEM" in Section 8.

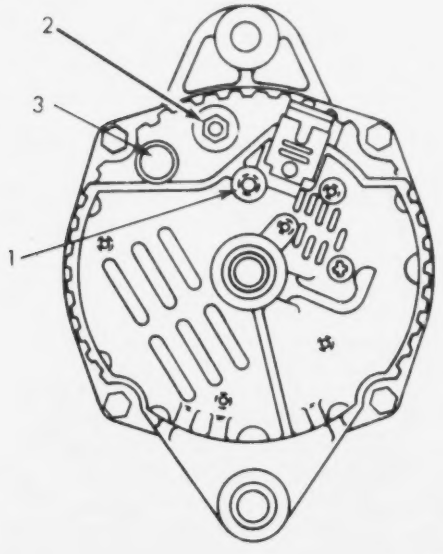
4. Be sure the battery terminals are clean and the battery cables are fastened securely to the correct terminals. Refer to "ELECTRICAL SYSTEM" in Section 8.

5. Be sure the terminals on the alternator (Fig. 1) are clean and the cables are fastened securely to the proper terminals as follows:

a. Output terminal (1) on alternator to cranking motor solenoid terminal "B."

b. Ground screw (2) on alternator to cranking motor frame bolt.

c. No cables are connected to the "R" (relay) terminal (3).




CE-107500

**Fig. 1. Alternator Connections**

## LUBRICATION WHEN SHIPPED

This machine has been lubricated at the factory for operation in an air temperature range of +49° C to -7° C (+20° F to +120° F) (see NOTE). If the machine is to be operated above or below this range, change to the correct lubricants. Unless an exception is shown below, all lubricants can be used (within above temperature range) until regular scheduled (normal) change interval occurs. Refer to "SERVICE GUIDE" in Section 7 for the scheduled (normal) change intervals and to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" for the proper oil grades for various air temperatures.

| COMPARTMENT | LUBRICANT |
|---|---|
| Crankcase ..... | EO ⊙ |
| Hydraulic Reservoir ..... | EO ⊕ |
| Transmission ..... | Dexron® △ |
| Transfer Drive Reservoir ..... | MPL |
| Axles ..... | MPL |

⊙ After the initial 100 hours of operation, replace the crankcase oil filters and change the oil. Thereafter, replace the filters and change the oil at the interval specified in Section 7.

⊕ After the initial 100 hours of operation, replace the hydraulic reservoir filters. Thereafter, replace the filters at the interval specified in Section 7.

△ After the initial 100 hours of operation, replace the transmission filter element and clean the transmission sump strainer. Thereafter, replace the filter element and clean the sump strainer at the interval specified in Section 7.

# INSTRUMENTS AND CONTROLS

This section covers the location and function of the various instruments and controls of this machine. In the case of controls, more detailed information regarding operation can be found in Sections 5 and 6.

Regardless of previous experience as an operator, you must be thoroughly familiar with the location and use of all instruments and controls before operating this machine. Check all instruments, immediately after starting, again upon reaching operating temperatures and at frequent intervals during operation to assure proper care through prompt detection of irregularities. If any of the instruments do not register properly, stop the engine; locate and correct the cause immediately.

## 1. TORQUE CONVERTER OIL TEMPERATURE GAUGE

This gauge registers the temperature of the fluid in the torque converter. After the engine has operated sufficiently to reach a stabilized torque converter temperature, tap the gauge lightly and check the reading. The gauge must register in the "RUN" (green area). If the gauge registers out of the "RUN" range, shift the transmission to a lower gear range and reduce engine speed. If this fails to bring the temperature into the "RUN" range, proceed as follows:

a. Stop the engine. Check the oil level in the transmission. Refer to "TRANSMISSION OIL" in Section 7.

b. Service the transmission filter. For filter servicing procedures, refer to "TRANSMISSION" in Section 8.

**NOTE:** *Continual high fluid temperatures should be corrected before resuming to operate the machine.*

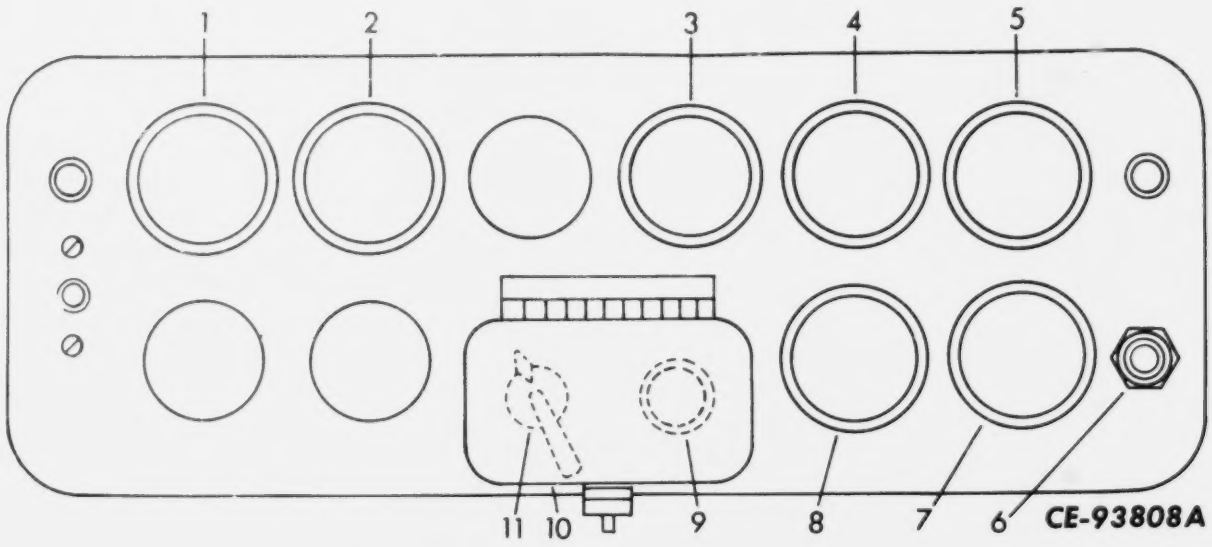



**Fig. 1. Instrument Panel**

1. Torque Converter Oil Temperature Gauge
2. Fuel Pressure Gauge
3. Air Pressure Gauge
4. Fuel Level Gauge
5. Engine Oil Pressure Gauge
6. Starter Switch
7. Engine Coolant Temperature Gauge
8. Voltmeter
9. Light Switch
10. Lock Box
11. Ignition Switch

# INSTRUMENTS AND CONTROLS

### 2. FUEL PRESSURE GAUGE

This gauge registers the pressure of the fuel from the fuel tanks through the fuel filters to the engine fuel injection nozzles.

The pointer of the gauge must register in the "RUN" (green) range when the engine is operating at high idle speed. When the pointer is in the "CHANGE FILTER" range (black area) while the engine is operating at this speed, it means that the primary fuel filter needs replacement; the primary and final fuel filters need replacement; or that the fuel system is clogged at some point. It may also be accomplished by a loss of power or misfiring of the engine.

### 3. AIR PRESSURE GAUGE

This gauge registers the amount of air pressure in the air tank. Tap the gauge lightly when checking the gauge reading. The unit should not be moved until the gauge is registering in the "RUN" (green) segment of the gauge.

### 4. FUEL LEVEL GAUGE

This gauge is electrically operated and indicates the available fuel supply in the fuel tank. Tap the gauge lightly when taking a reading.

### 5. ENGINE OIL PRESSURE GAUGE

This gauge shows the pressure at which the lubricating oil is circulating through the engine. This gauge must register in the "IDLE" range immediately upon starting. When the engine is operated at full load speed, the pointer must be in the (green) "RUN" range. Stop the engine immediately and investigate cause if little or no pressure is indicated.

The oil pressure gauge gives some indication of the oil condition once it is at operating temperature. Pressure drops between oil changes may be caused by oil dilution, a clogged crankcase suction strainer or an internal engine oil leak. Always determine the cause of decreased from normal engine oil pressure.

### 6. STARTER SWITCH

Turn the combination switch to the ignition position and press the starter switch to crank the engine. After the engine starts to run release the starter switch.

**NOTE:** *Never press the starter switch while the engine is running. This will damage the cranking motor and the engine flywheel.*

### 7. ENGINE COOLANT TEMPERATURE GAUGE

This gauge shows the temperature of the coolant circulating through the engine. After the engine has operated a sufficient length of time the pointer of the gauge must be in the (green) "RUN" range.

During normal operation, the gauge readings should vary between the minimum and maximum indicated by the "RUN" (green) segment of the gauge.

Continuous engine operation below the minimum temperature is harmful to the engine oil. Low coolant temperatures will also cause exhaust smoke and increase the rate of fuel consumption.

Overheating indicates the need for mechanical correction. A clogged cooling system or a low coolant level will also cause high operating temperatures. The engine temperature, under full load conditions, should remain below the maximum reading listed.

### 8. VOLTMETER

The voltmeter indicates the condition of the batteries. When the engine is not running or is running at low idle speed, the gauge pointer should be within the left green area, which indicates a good battery charge. If the voltage drops below the left green area at low idle speed, the batteries should be checked. With the engine operating above low idle speed, the gauge pointer should be within the right green area, which is the normal operating range. If the voltage drops below the right green area, the batteries and/or alternator should be checked.

### 9. LIGHT SWITCH

The ignition switch must be turned "ON" before the lights will operate. The light switch has two positions. When pulled out to the first position the front driving lights, tail and stop lights and instrument panel lights will come on. If pulled out to the second position the rear driving lights will also come on. Push the switch all the way in to turn the lights off. If the machine is equipped with low-level lights, they will go on and off the same time as the driving lights.

### 10. IGNITION SWITCH

The ignition switch has two positions: "ON" and "OFF". In the "OFF" position there is no electric current flow to any circuit. In the "ON" position electric current is allowed to flow to all circuits. The ignition switch must be in the "ON" position before the engine can be started or cranked.

### 11. LOCK BOX

The instrument panel is equipped with a lock box over the ignition switch and light switch. This box can be locked closed to prevent unauthorized people from starting the machine or turning the electrical components on which could drain the charge in the batteries.

### 12. PARKING BRAKE WARNING LIGHT (Fig. 2)

This light will be on when the parking brake is applied and the ignition switch is turned on.

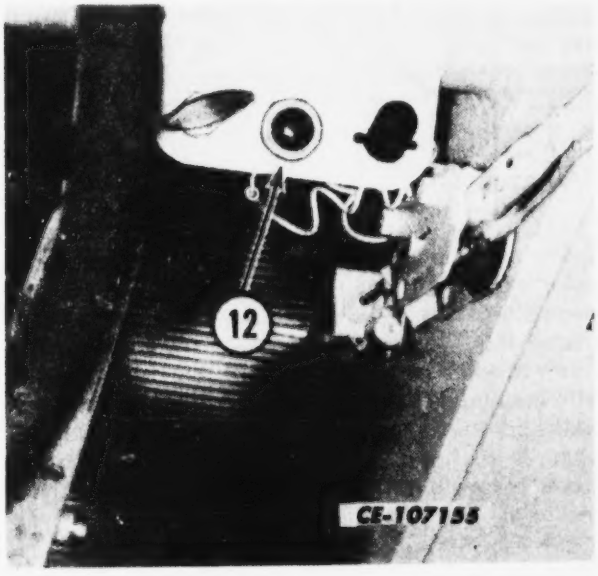



**Fig. 2. Parking Brake Warning Light**

### 13. SERVICE RECORDER (Fig. 3)

The service recorder is mounted on the crankcase cover on the fan end of the engine. The service recorder is geared to the engine, and when the crankshaft turns a specific number of revolutions in an hour at average operating speeds on an average job application, the dial advances one number. Different job applications will cause the service recorder to differ from the amount of clock hours worked. The purpose of a service recorder is to indicate when to perform the recommended maintenance and lubrication operations. The intervals in this manual are given in service hours, so daily readings will tell you when to service the machine. Rely on the service recorder and not the clock to measure service intervals.

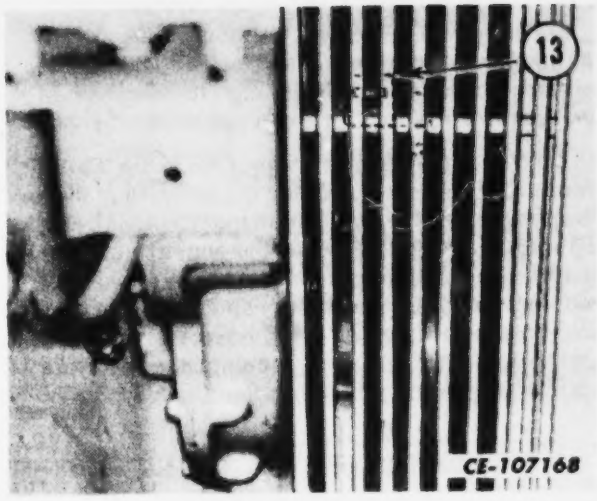



**Fig. 3. Service Recorder**

### 14. AIR CLEANER SERVICE INDICATOR (Fig. 4)

The air cleaner service indicator is located between the reservoir and left battery box. During operation the red band will gradually rise in the indicator window (A) as dirt accumulates in the air filter elements. THIS MUST NOT BE MISTAKEN AS A SIGNAL FOR ELEMENT SERVICE. When the filter elements reach the maximum allowable restriction, the red band will completely fill the indicator window and automatically lock in this position.

The red band will remain fully exposed even after stopping the engine. When this happens, filter element service is required. For air cleaner service instructions, refer to "AIR CLEANING SYSTEM" in Section 8. Press the reset button (B) on top of the indicator after the elements have been serviced.

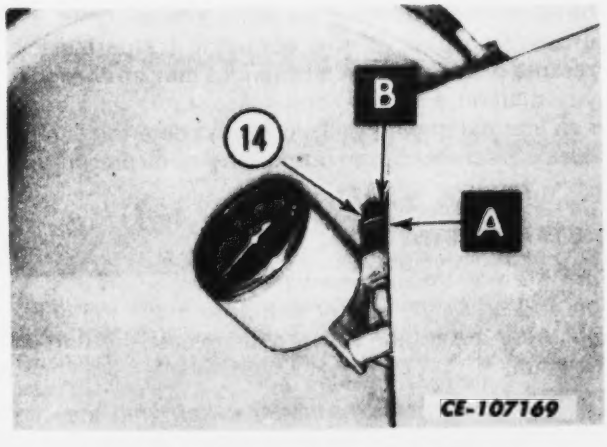



**Fig. 4. Air Cleaner Service Indicator**

# INSTRUMENTS AND CONTROLS

### 15. TACHOMETER (If Equipped) (Fig. 5)

The tachometer is mounted on a bracket at the front of the rear frame section.

It is visible to the operator from the operator's seat. It indicates engine speed in hundreds of revolutions per minute and is used to check engine crankshaft speed.

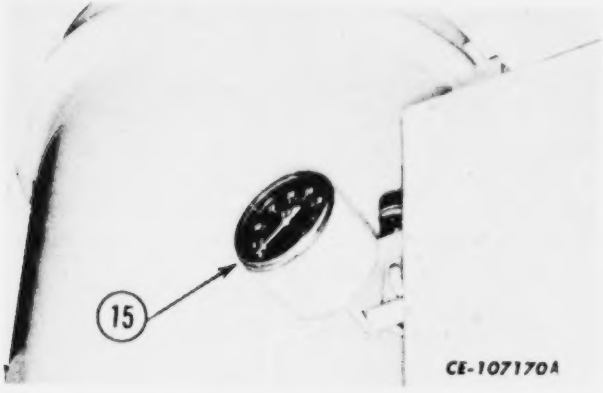



**Fig. 5. Tachometer**

### 16. TRANSMISSION CLUTCH PRESSURE GAUGE (If Equipped) (Fig. 6)

This gauge registers the pressure of the oil being delivered to the clutch packs in the transmission. The gauge should be connected only when pressure checks are being made. After the engine has operated a sufficient length of time, the gauge must register 170-200 psi. If the pointer is below or above the normal operating pressure, stop the engine and service the transmission oil filter. Refer to "TRANSMISSION" in Section 8. If after servicing the filter, the pointer still registers below or above the normal operating pressure, stop the engine and consult your PayLine Distributor before operating the machine. This gauge should be disconnected when checks are completed as the extreme pressure changes to which the gauge is subjected will greatly reduce the gauge life.

### 17. HYDRAULIC OIL PRESSURE GAUGE (If Equipped) (Fig. 6)

This gauge registers the pressure of the oil being delivered to the main hydraulic valve. The gauge should be connected only when pressure checks are being made. The gauge should give a pressure reading of 2500 psi maximum.

### 18. HIGH ENGINE COOLANT TEMPERATURE WARNING LIGHT (If Equipped) (Fig. 6)

The high engine coolant temperature light will flash on and off if the engine coolant exceeds 392° C (200° F). If the light comes on shut the engine down immediately and correct the cause of overheating.

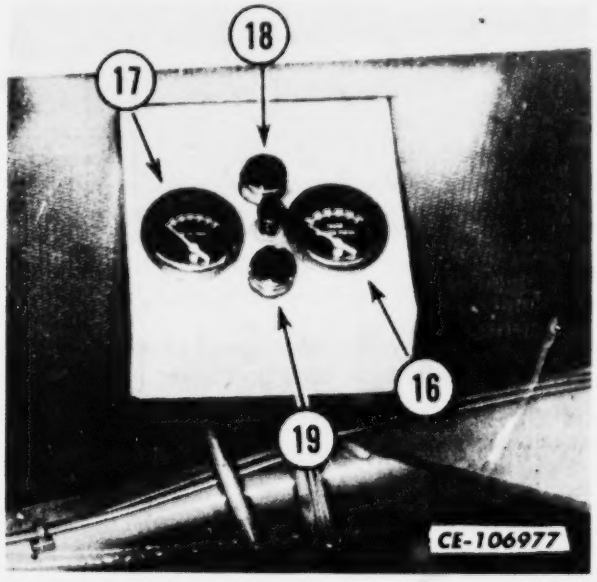



**Fig. 6. Auxiliary Instruments**

16. Transmission Clutch Pressure Gauge
17. Hydraulic Oil Pressure Gauge
18. High Engine Coolant Temperature Warning Light
19. Low Engine Oil Pressure Warning Light

### 19. LOW ENGINE OIL PRESSURE WARNING LIGHT (If Equipped) (Fig. 6)

The low engine oil pressure warning light will flash on and off if the oil pressure drops below 103 kPa (15 psi). If the light comes on shut the engine down immediately and correct the cause of low oil pressure.

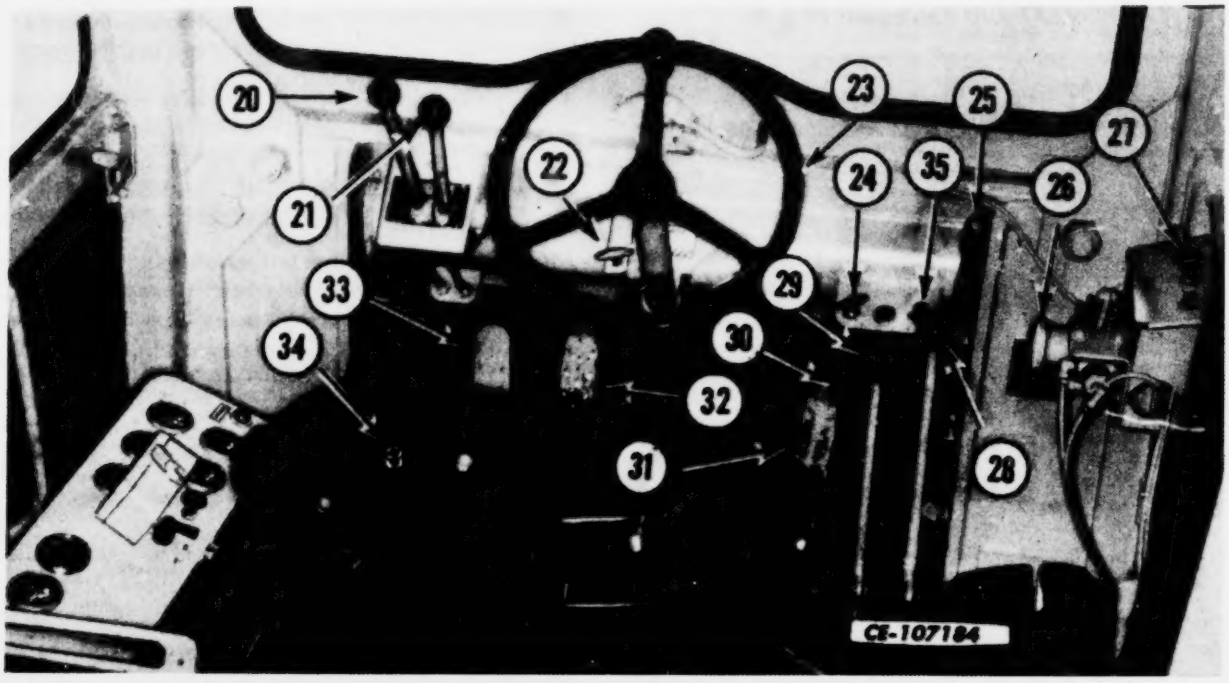



**Fig. 7. Controls**

20. Transmission Gear Range Lever
21. Transmission Direction Lever
22. Engine Shutdown Control
23. Steering Wheel
24. Hand Throttle Control
25. Parking Brake Lever
26. Boom Stop Positioner Control
27. Window Wipers Control
28. Boom Control Lever
29. Bucket Control Lever
30. Third Spool Control Lever (if equipped)
31. Accelerator Pedal
32. Brake Pedal
33. Brake and Transmission Disconnect Pedal
34. Horn Button
35. Ether Injector Button (if equipped)

### 20. TRANSMISSION GEAR RANGE LEVER

This lever is used to select any one of the transmission gear ranges. For additional information refer to "DRIVING THE MACHINE" in Section 5.

### 21. TRANSMISSION DIRECTION LEVER

This lever is used to select machine direction. Refer to "DRIVING THE MACHINE" in Section 5 for additional information.

### 22. ENGINE SHUTDOWN CONTROL

The engine shutdown control is located to the left of the steering column on the underside of the instrument panel box. Pull the control handle out all the way to shut the engine down. After the engine has stopped completely, push the handle back in. The shutdown control stops the fuel supply to the engine.

### 23. STEERING WHEEL

The steering wheel operates the steering valve, which directs hydraulic fluid into the steering cylinders. When the steering wheel is turned clockwise, the steering cylinders articulate the machine so a right turn can be made. When the steering wheel is turned counterclockwise, the machine is articulated so a left turn can be made. The machine continues to articulate as long as you turn the steering wheel. When you stop turning the steering wheel, the machine will remain in the articulated position it is in.

# INSTRUMENTS AND CONTROLS

### 24. HAND THROTTLE CONTROL

The hand throttle is used to keep the engine running at a speed higher than low idle without keeping the accelerator pedal depressed. Turn the handle to the left or right to unlock it. Pull the control out until the engine is running at the desired speed. Turn the handle to the left or right to lock it into this position. Push the control in before leaving the operator's compartment.

### 25. PARKING BRAKE LEVER

To apply the parking brake push the lever up and forward; to release pull back and down. It is recommended that the parking brake only be used to hold the machine after it has come to a stop. However, should the brake system ever fail, the parking brake may be used to make an emergency stop.

**CAUTION! The parking brake should always be applied when the operator is not in the driver's seat.**

### 26. BOOM STOP POSITIONER CONTROL (Fig. 8)

The boom is equipped with an air operated stop positioner system. The system will automatically stop the boom to any preselected position of its raising arc.

A rod (1) is connected to the boom arm and the positioner control cam plate (2). When the boom control lever is pulled all the way back into the detented RAISE position, the rod (1) moves back and turns the cam plate (2) as the boom raises. The cam follower(s) on the actuating lever (3) follows the cam surface. When the follower contacts the cam lobe (6), the actuating lever (3) upsets the system control valve (4). Compressed air from the machine's air system passes from the brake treadle valve through the upset air valve (4) and into the boom control spool of the main hydraulic valve. The compressed air acts against a piston in the spool assembly. The air pressure on the piston overcomes the detent plunger spring pressure and the spool centering spring returns the spool and boom control lever to the HOLD position.

To set the boom stopping height raise the boom to the desired stopping position. Turn the cam adjusting knob (7) and position the cam lobe (6) under the cam follower (5) until it actuates the air valve (4). Lower the boom and raise it again to check the adjustment.

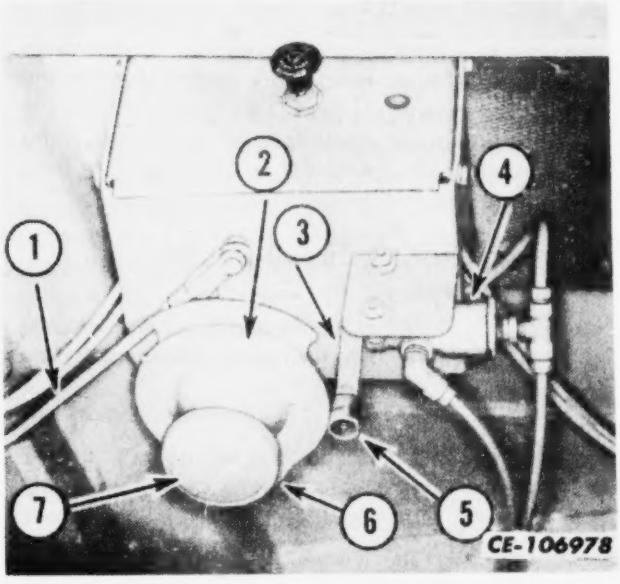



**Fig. 8. Boom Stop Positioner Control**

1. Control Rod
2. Cam Plate
3. Air Valve Actuating Lever
4. Air Valve
5. Cam Follower
6. Cam Lobe
7. Adjusting Knob

### 27. WINDOW WIPER CONTROL

Pull the wiper control knob out to turn the window wipers on. Push the knob in to turn them off. After turning on the wipers, the speed may be increased by turning the knob clockwise or decreased by turning the knob counterclockwise.

### 28. BOOM CONTROL LEVER

The boom control lever is the far right lever to the right of the operator's seat. This lever controls the raising and lowering operation of the booms. Refer to "LOADING MECHANISM OPERATION" in Section 5 for additional information.

**CAUTION! The boom assembly, if raised, can be lowered any time the lever is moved to float or lower position whether the engine is running or not. Always lower the boom to the ground when it is not in use.**

### 29. BUCKET CONTROL LEVER

The bucket control lever is the left lever (center lever if equipped with the third spool control lever) to the right of the operator's seat. This lever controls the roll back and dump operations of the bucket. Refer to "LOADING MECHANISM OPERATION" in Section 5 for additional information.

### 30. THIRD SPOOL CONTROL LEVER (If Equipped)

This lever controls any attachment which requires hydraulic power from a third spool on the main control valve.

### 31. ACCELERATOR PEDAL

Depress this pedal to increase the engine speed; release the pedal to decrease the engine speed.

### 32. BRAKE PEDAL

Depress the brake pedal according to the machine's speed and the road conditions then slowly release the pedal as the machine's speed decreases. When the machine comes to a complete stop, there should only be enough pressure to hold it stationary.

### 33. BRAKE AND TRANSMISSION DISCONNECT PEDAL

This pedal works in the same manner as the brake pedal except that it also stops clutch pressure in the transmission. When this pedal is depressed no power can be transmitted through the transmission and full engine power can be used to operate the machine hydraulics while braking.

### 34. AIR HORN BUTTON

The horn button is located on the floorboard to the left of the brake and transmission disconnect pedal. Step on the button to sound the horn.

### 35. ETHER INJECTOR BUTTON (If Equipped)

The ether injector button injects ether into the engine when pressed down. The ether aids in starting the engine during cold weather.

**NOTE:** *The ether injector should be used only when the air temperature is below freezing.*

Refer to "STARTING THE ENGINE" in Section 5 for operation of the ether injector.

### 36. HEATER AND DEFROSTER CONTROL (If Equipped) (Fig. 9)

The heater and defroster are controlled by a two speed switch.

**NOTE:** *The heater unit is connected to the engine by water hoses. Each hose is connected to a shut-off valve at the engine. Be sure the valves are open when the heater and defroster are being operated. Turn off the valves when the heater is not being used during the warm seasons.*

Turn the switch clockwise 45° for high speed; 90° for low speed. Turn the switch as far as it will go counterclockwise to turn the fan off. This heater unit is also a cab pressurizer. The pressurizer can be used during the warm seasons without heat by closing the heater hose shut-off valves at the engine.

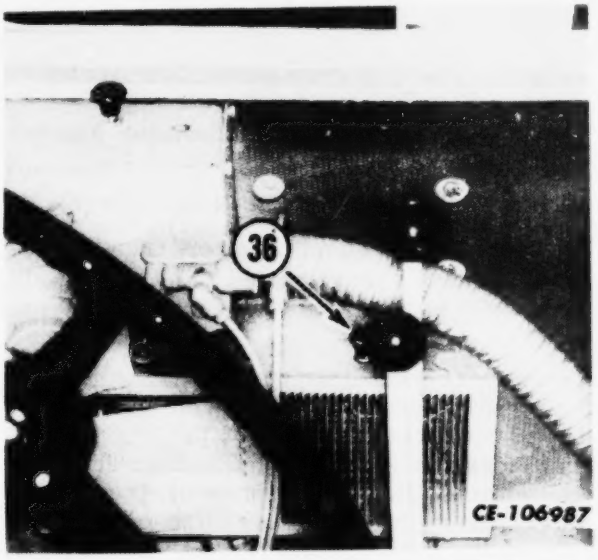



**Fig. 9. Heater and Defroster Control**

### 37. ELECTRICAL SYSTEM MASTER SWITCH (Fig. 10)

Turn the switch "OFF" to cut out the electrical system. Remove the key to lock the switch in the "OFF" position.

### SEAT CONTROLS

For operator's convenience in reaching the controls and improved operating visibility, the operator's seat can be adjusted to various positions.

**CAUTION! Do not adjust the seat position while the machine is in motion.**

# INSTRUMENTS AND CONTROLS

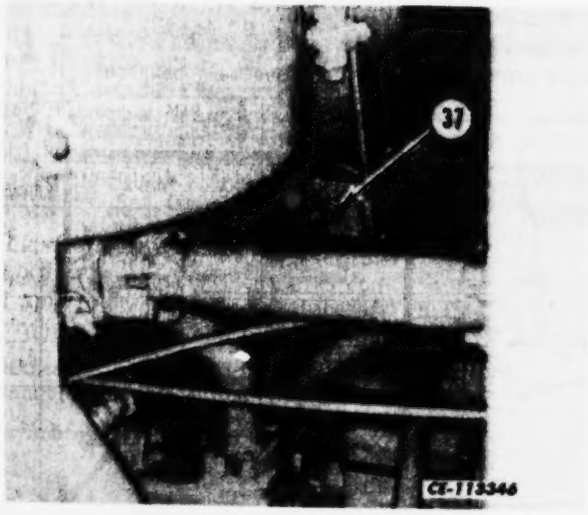



**Fig. 10. Electrical System Master Switch**

**Pedestal Mounted Seat (Fig. 11)**

To adjust the seat forward or backward push the lever (1) back and slide seat in the desired direction. Lever (2) allows the seat to tilt forward or back. Pull up on the tilt lever to adjust the tilt of the seat.

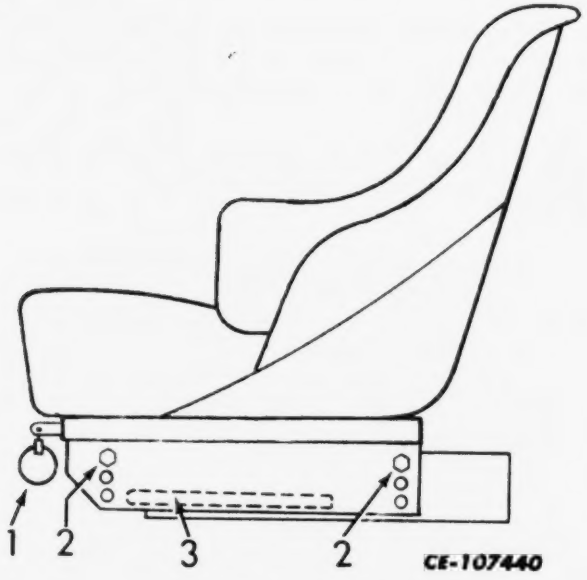



**Fig. 11. Seat Controls**

1. Tilt Latch Release Chain
2. Height Adjustment Bolts
3. Forward or Backward Slide Release Lever

The height can be adjusted by removing the two bolts (3) that secure the inner post to the outer post and lining up the holes in both posts at a higher or lower setting. Be sure to replace the two bolts with the heads of the bolts towards the front of the seat.

To adjust the seat forward or backward, pull the lever (3) under the seat to the left and slide the seat to the desired position; then release the lever. The height can be adjusted by removing the two bolts (2) from both sides of the seat base and lining up the holes at a higher or lower setting; then reinstalling the bolts. The seat is hinged to the base and can be tilted all the way forward. Pull the chain (1) at the lower front of the seat to release the latch that is securing the seat.

**Air Suspension Seat (Fig. 12)**

The air suspension seat has an air shock absorber which receives compressed air from the machine air system and thus allows the operator to adjust the firmness of the seat suspension by regulating the amount of air in the shock absorber. Adjustments are made as follows:

**CAUTION! Do not adjust the seat position while the machine is in motion.**

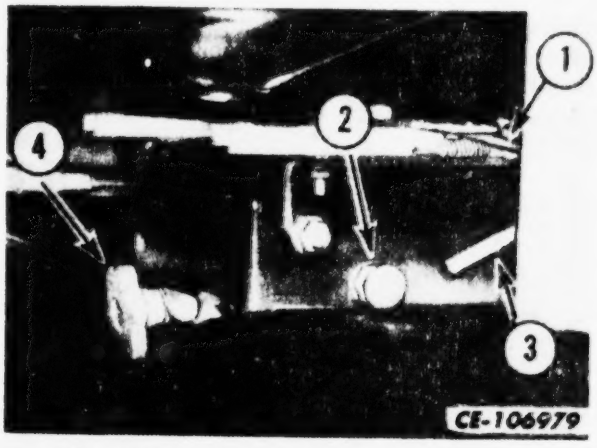



**Fig. 12. Air Suspension Seat Adjustment**

1. Forward and Rear
2. Air Control
3. Tilt Control
4. Height Adjustment

1. Push or pull air knob (2) for desired firmness of ride.

2. Rotate front knob (4) clockwise to raise the seat.

3. Lift rear handle (3) to adjust angle of seat. Do not adjust the tilt while sitting in the seat.

4. Release side handle (1) for front or rear seat adjustment.

**NOTE:** *Check and tighten loose bolts at regular intervals to prevent excessive bushing wear.*

# PREPARING FOR EACH DAY'S WORK

**1. Coolant Level (Fig. 1).** Correct level is 25mm (1 in.) above baffle.

**NOTE:** *Do not operate engine before checking coolant level.*

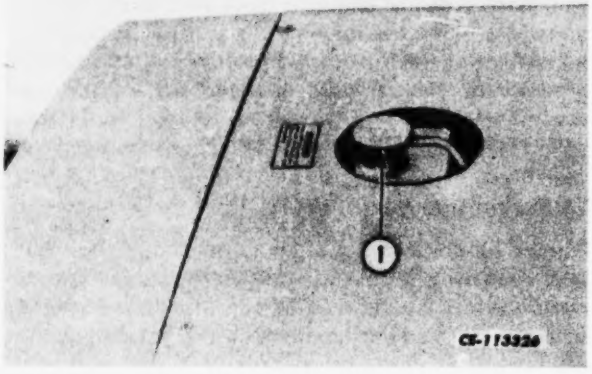



**Fig. 1**

**2. Pre-Cleaner Hood and Dust Vacuator Valve (Fig. 2).** Loosen clamp screw and remove the hood by twisting and pulling upward. Clean the screen with compressed air or wash in hot water preferably containing a small amount of non-sudsing detergent. Squeeze dust vacuator valve (2A) to clear it of accumulated dust.

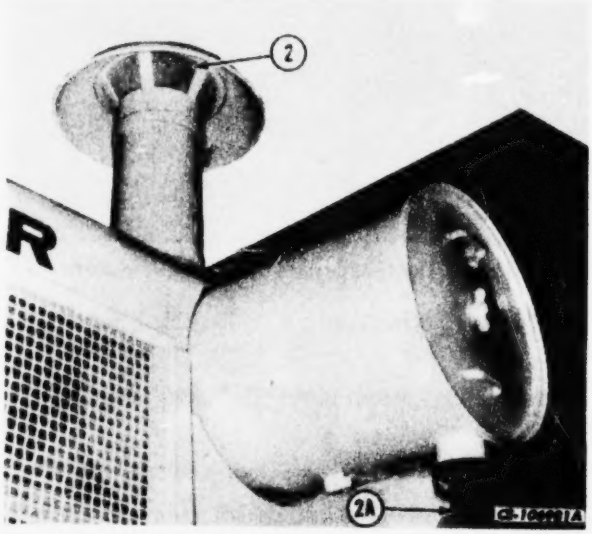



**Fig. 2**

1. Pre-Cleaner Hood
2A. Dust Vacuator Valve

**3. Fuel Tank (Fig. 3).** Be sure the fuel tank is full. Fill the tank at the end of each day's operation to reduce condensation of moisture.

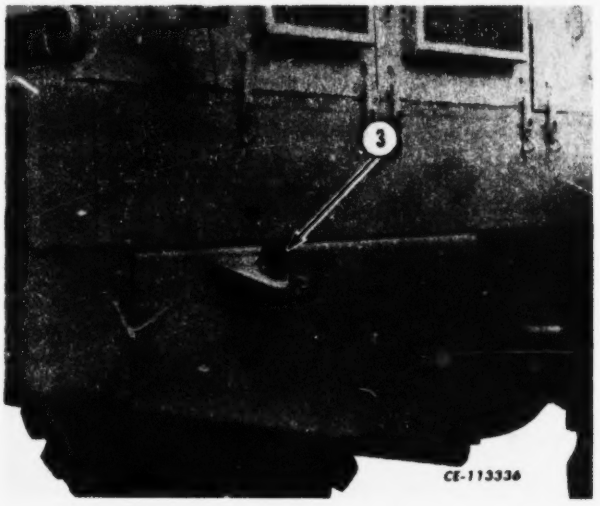



**Fig. 3**

**4. Air Tank Drain Valves (Fig. 4).** Open the air tank drain valves a maximum of two turns. Drain accumulated water, then close the valves.

**CAUTION! Do not open the valves more than the prescribed amount.**

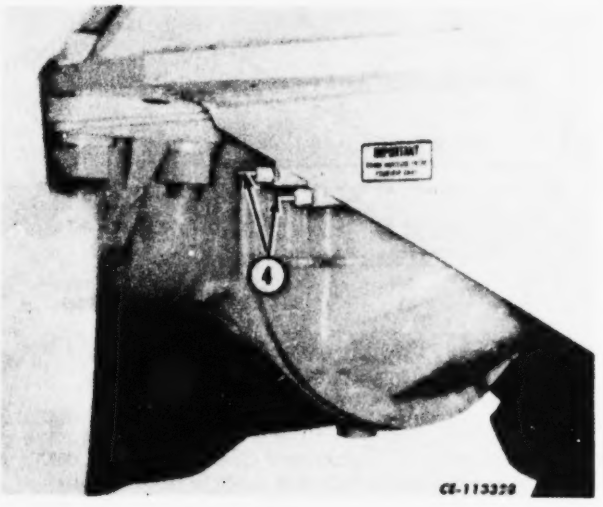



**Fig. 4**

# PREPARING FOR EACH DAY'S WORK

**5. Alcohol Evaporator (If Equipped) (Fig. 5).** Check level of alcohol. Refer to "ALCOHOL EVAPORATOR" in Section 8 for procedure.

**6. Lubrication.** Perform each of the 10 hour lubrication requirements shown on the "SERVICE GUIDE" in Section 7.

LOOK FOR LEAKS AND DETERMINE THEIR SOURCE SO THAT THEY CAN BE CORRECTED.

CHECK HEADLIGHTS FOR OPERATION. ALSO CHECK TAILLIGHT, STOPLIGHT AND BACK-UP LIGHT (if equipped).

CLEAN ALL GLASS (WINDOWS, WINDSHIELD, AND INSTRUMENTS).

CHECK TIRES FOR CUTS, TREAD WEAR, PROPER INFLATION.

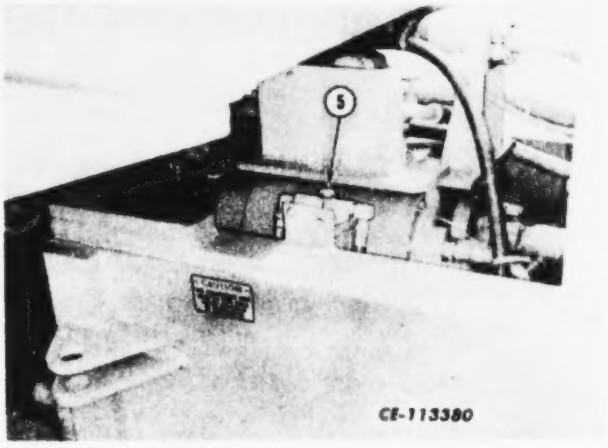



Fig. 5

# WORK SAFELY — FOLLOW THESE RULES

**This symbol is used to call your attention to instructions concerning your personal safety. Be sure to observe and follow these instructions, and be certain anyone operating this machine is aware of these safety rules.**

**A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT.**

## CAUTIONS!

Never operate the engine at more than the regular governed speed shown on the serial number plate. Excessive speeds are harmful and dangerous. Do not rework or modify engine flywheel.

Use caution in removing radiator cap when the engine is hot.

Never refuel while the engine is running.

Do not smoke while refueling.

PROVIDE PROPER VENTILATION WHEN OPERATING A MACHINE IN A CLOSED BUILDING.

ONLY ONE PERSON, THE OPERATOR, SHOULD BE PERMITTED TO RIDE ON THE MACHINE WHEN IT IS IN OPERATION.

Use commercial solvent or kerosene for cleaning parts unless otherwise specified.

Never operate the engine when cleaning or lubricating the machine.

When it is required to make any checks with the engine running, always use two men; one man must be in the operator's seat while the other does the checking. As an added precaution, when making checks with the engine running, place the transmission directional lever in the neutral (N) position, apply the parking brake and install safety bar and pins.

CLEAR IMMEDIATE AREA OF PERSONNEL OR OBSTRUCTIONS BEFORE STARTING ENGINE.

BEFORE DRIVING THE MACHINE, FASTEN THE SEAT BELT.

AFTER STARTING THE ENGINE BUT BEFORE MOVING THE MACHINE, WARN NEARBY PERSONNEL WITH THE HORN.

When leaving the loader unattended, always place the transmission directional lever in neutral (N) position and apply the parking brake.

Never leave the loader unattended while the engine is running. When parking the loader, be sure bucket is lowered completely to prevent damage or injury possibilities. DO NOT ALLOW THE HYDRAULIC SYSTEM TO SUPPORT THE BOOMS WHEN LEAVING THE LOADER UNATTENDED.

CARRY BUCKET LOW FOR MAXIMUM VISIBILITY.

LOWER BUCKET BEFORE MAKING HYDRAULIC ADJUSTMENTS. TO PREVENT PERSONAL INJURY, BE SURE NO PERSONNEL ARE STANDING IN THE WAY OF THE BUCKET WHEN IT IS BEING LOWERED.

NEVER WORK BENEATH BUCKET WITHOUT PROPER BLOCKING.

Always sit in the operator's seat before operating any controls.

Never wear a seat belt across the abdomen.

The roll-over protective structure (R.O.P.S.) provides operator protection in the event of machine roll-over or upset. These structures are designed to bend during a roll-over to protect the operator from sudden impact loads.

# OPERATING THE MACHINE

## CAUTIONS!

Federal regulations prohibit repair to R.O.P.S. after damage occurs. DO NOT attempt to repair a protective structure for further service after an accident. Repaired structures do not provide the original strength and protection. Contact your PayLine Distributor for information on R.O.P.S. replacement.

DO NOT SERVICE OR TRANSPORT THE MACHINE UNLESS THE SAFETY BAR AND PINS ARE IN PLACE.

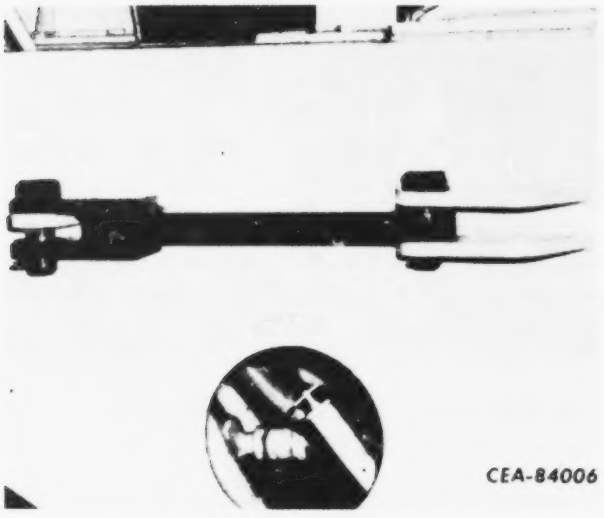



**Fig. 1. Safety Bar and Pins Stowed**

To lock the loader halves in straight position, the bar and two pins are used as shown in Fig. 2.

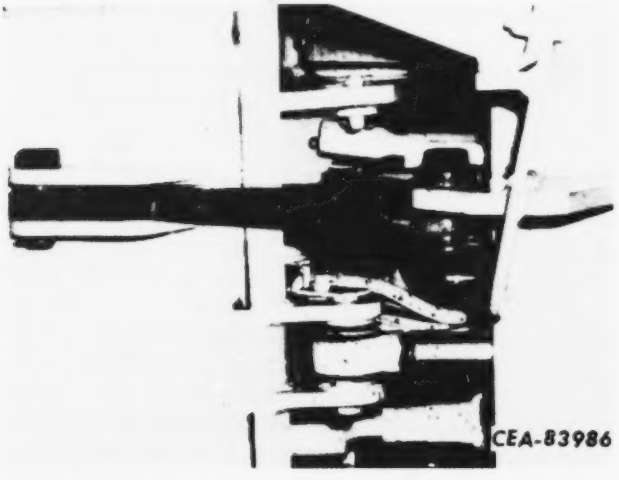



**Fig. 2. Safety Bar in Straight Lock Position**

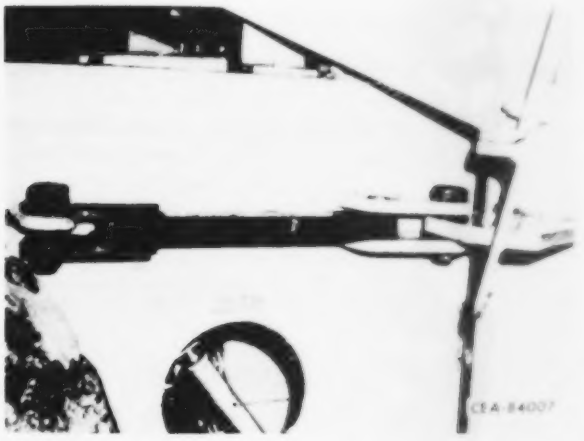



**Fig. 3. Safety Pin Installed in Full Turn Lock Position**

To lock the machine in a full turn, only one pin is used. Turn the machine to its full turn position and insert the pin through the holes on the closed side of the machine. Refer to Fig. 3.

Always check that the bar and pins have been replaced in storage position on the left side of the loader (Fig. 1) before operating.

Broken or lost safety bar and pins should be repaired or replaced immediately to insure that the safety device is always available for use. Do not attempt to service or transport the loader if the safety bar or pins are broken or missing.

## MACHINE PRECAUTIONS

Before starting or operating this machine, read the following general precautions. These are listed here to help you protect the machine and to remind you of protection for yourself and those around you. Sound judgement and observance of these rules will help make your job a safer one.

Do not place the loader under load without the proper engine oil pressure and operating temperature.

To prevent any possible damage to the alternator, the electrical system master switch must be in the "ON" position when the engine is running. The switch must be in the "OFF" position only when the engine is shut down at the end of each day or when the operator leaves the loader unattended.

Never shift the transmission into neutral when going downhill. The machine may go out of control or the transmission, converter or engine may be damaged when the transmission is again placed in gear.

During normal operation, the turbocharger must be free from vibration and unusual noises.

## STARTING THE ENGINE

**NOTE:** *Step numbers correspond with the numbers shown in Fig. 4.*

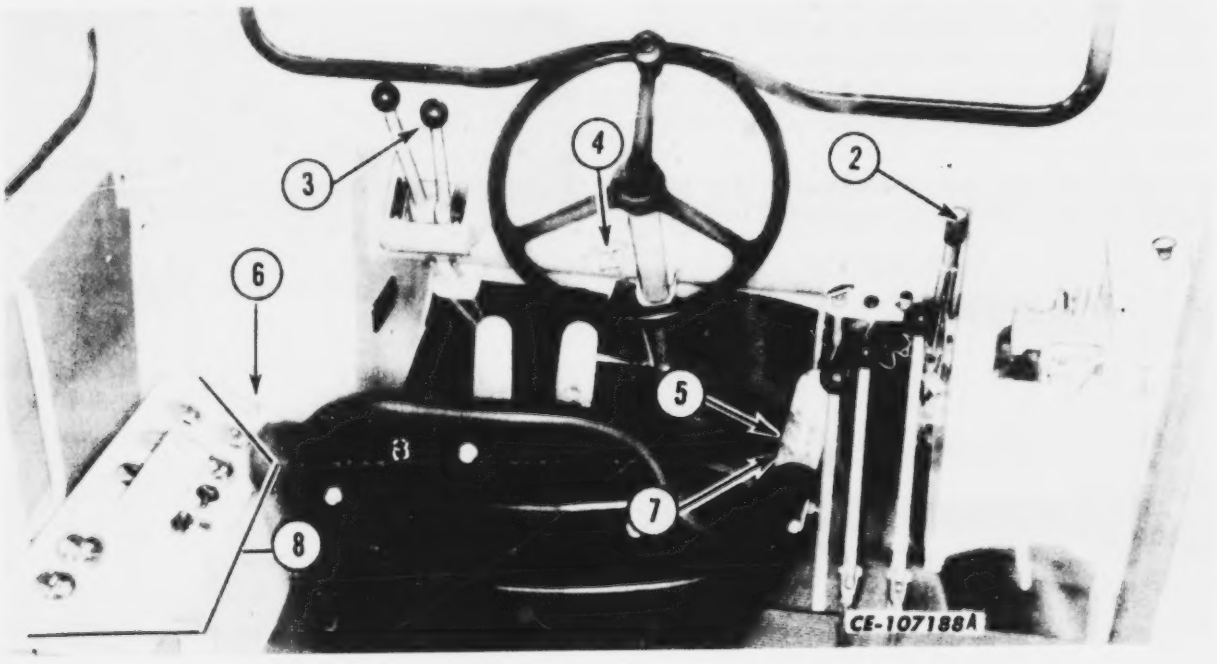



**Fig. 4. Starting the Engine**

**NOTE:** *The turbocharger must be primed when the engine has been idle for 30 days or more. Refer to "TURBOCHARGER" in Section 8.*

1. (Not illustrated.) Turn the electrical system master switch to the on position.

2. Be sure the parking brake is applied.

3. Be sure the transmission directional lever is in neutral (N).

4. Be sure the engine shut-down cable is pushed in all the way.

5. Depress the accelerator pedal to the one-half engine speed position at temperatures above +10° C (+50° F) or to the full speed position at temperatures below +10° C (+50° F).

6. Crank the engine as follows:

   a. NORMAL START: Turn the ignition and light switch to the "IGNITION" position and press the starting button. Release the button the instant the engine starts.

**NOTE:** *To avoid possible damage to the cranking motor release the starting button the instant the engine starts. Never press the button while the engine is running.*

b. USING ETHER INJECTOR:

**CAUTION! The ether injector should be used only for starting the engine. Misuse of the ether injector while the engine is running can result in serious damage to the engine.**

**NOTE:** *The ether injector should be used only when the air temperature is below freezing.*

Depress the accelerator pedal to the full speed position. Push the ether injector button and hold for 2 to 3 seconds to fill the ether chamber of the ether starting valve with a measured amount of ether. Simultaneously engage the cranking motor as instructed under "Normal Start" and push in the ether injector knob allowing 2 to 3 seconds for the ether to enter the engine. If the temperature is below zero it may be necessary to inject additional ether.

# OPERATING THE MACHINE

**NOTE:** *If the engine does not start with a maximum of two ether injections, determine and correct the cause before attempting again to start the engine.*

**NOTE:** *Crank engine for 30 seconds at a time. If engine does not start, allow cranking motor to cool two or three minutes before cranking again.*

If the engine will not start or runs roughly, it may be due to one of the following:

a. Air may be in the fuel system. Refer to "FUEL SYSTEM" in Section 8.

b. Ether injector is not functioning properly. Refer to "ETHER INJECTOR" in Section 8.

c. Fuel filters may be clogged. Refer to "FUEL SYSTEM" in Section 8.

7. Immediately after the engine starts, release the accelerator pedal.

**NOTE:** *Check the engine oil pressure gauge and if no oil pressure is indicuted, immediately stop the engine.*

8. Check all instruments for proper operation. Refer to "INSTRUMENTS AND CONTROLS" in Section 3.

## DRIVING THE MACHINE

**NOTE:** *Step numbers correspond with the numbers shown in Fig. 5.*

**NOTE:** *Before operating check all instruments. Refer to "INSTRUMENTS AND CONTROLS" in Section 3.*

1. Depress brake pedal.

2. Release the parking brake.

3. Partially accelerate the engine and raise the bucket enough to clear the ground.

4. Set the transmission direction lever in the desired position.

**NOTE:** *The back-up alarm (if equipped) should sound when the transmission direction lever is placed in reverse (R).*

5. Place the gear range lever in the first (1) gear position.

6. Release the brake pedal and gradually depress the accelerator pedal. Refer to "SHIFTING GEARS" in this section for transmission shifting instructions.

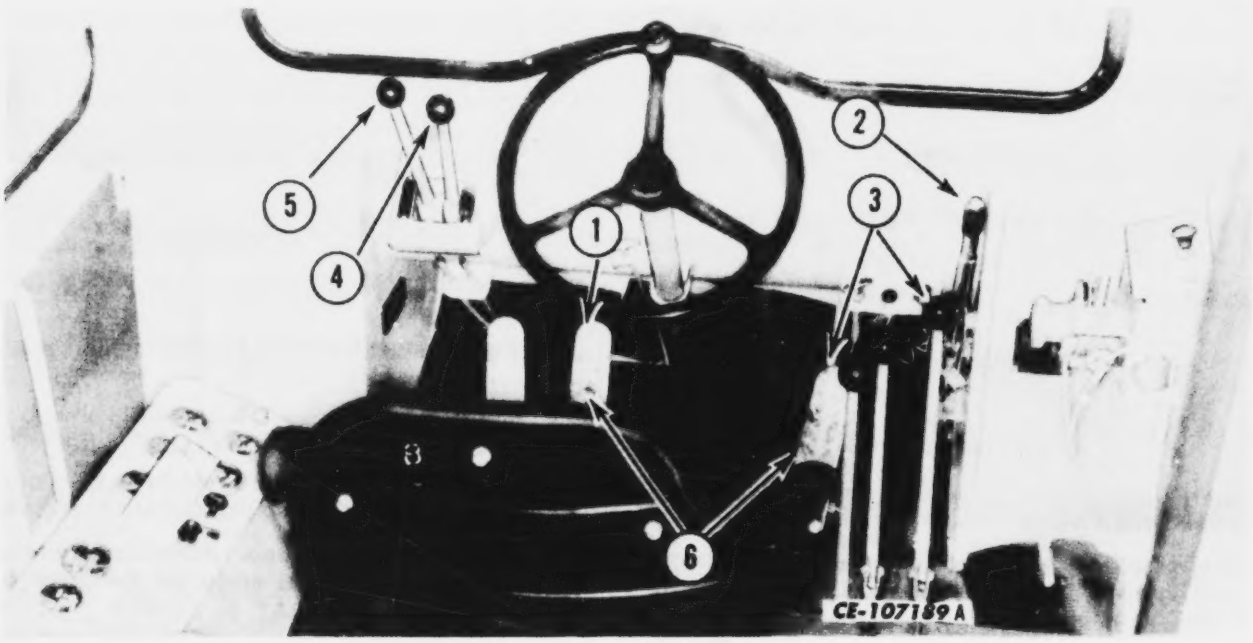



**Fig. 5. Driving the Machine**

### HIFTING GEARS

The transmission has four forward gear ranges, four reverse gear ranges and neutral which are manually selected with the transmission gear range and direction levers.

"1" (first gear) and "2" (second gear) are the main working ranges. "3" (third gear) can be used for roading over rough terrain or roading with a loaded bucket. "4" (fourth gear) is used to road the machine for longer distances at maximum machine speeds. The direction lever "N" (neutral) position has a neutral start safety switch incorporated in it. The direction lever must be in "N" before the engine can be started. "R" (reverse) also has "1" (first), "2" (second), "3" (third) and "4" (fourth) gear ranges.

#### Down-Shifting

Range "down shifts" (except in emergency) should never be made at a vehicle ground speed higher than that possible in the next lower gear range. Down shifting while in motion (especially to 1st speed range) should be accomplished in a full engine RPM throttle condition.

#### Up-Shifting

Range "up shifts" can be made at any time, or engine RPM, at which the higher gear range will propel the vehicle efficiently. It is recommended to anticipate the engine RPM dictated by the higher gear range and decelerate the engine accordingly.

#### Directional-Shifting

Decelerate the engine in all direction changes.

Use the right brake treadle to determine the stop or cycle distance.

Change the directional control lever position in a manner to smoothly coordinate: a) the vehicle stop; b) the transmission re-engagement; and c) the engine acceleration.

### STEERING

The machine is articulated and steering is accomplished by hydraulic power which pivots the main frames at the center hinge. Turn the steering wheel until reaching the desired angle of turn. Hydraulic power holds the angle of turn until the steering wheel is again turned.

## LOADING MECHANISM OPERATION

The hydraulic system provides power for the boom and bucket. When the bucket circuit is being operated, flow to the boom circuit is cut off.

**NOTE:** *Holding a control lever in any position except HOLD or FLOAT for an extended period of time after the hydraulic cylinder rod has reached the limit of its travel will produce excessive heat in the hydraulic system which may affect loader performance.*

### BOOM CONTROL LEVER (Fig. 6)

The boom control lever is the lever at the far right of the operator's seat. It has four positions. They are: RAISE, HOLD, LOWER and FLOAT.

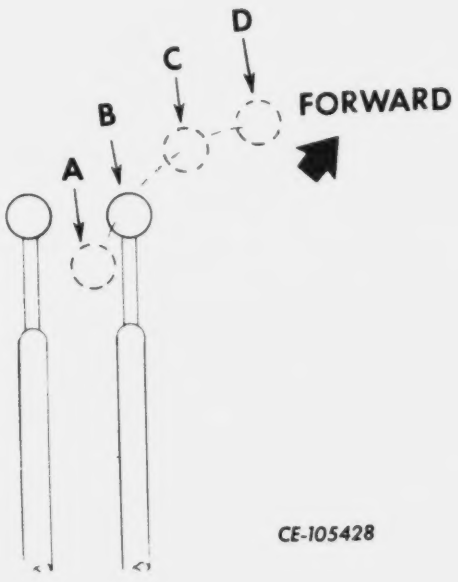



**Fig. 6. Boom Control Lever Positions**

A. RAISE
B. HOLD
C. LOWER
D. FLOAT

**CAUTION! The boom assembly, if raised, can be lowered any time the lever is moved to FLOAT or LOWER position whether the engine is running or not. Always lower the boom to the ground when it is not in use.**

# OPERATING THE MACHINE

**Raise (A, Fig. 6)**

To raise the booms, pull the lever back as far as it will go. A detent in the valve locks the lever in this position. The return HOLD can be done manually or will be done automatically when the boom reaches the preset stopping height of the boom stop position. Refer to "BOOM STOP POSITIONER" in this section for additional information.

**Hold (B, Fig. 6)**

The control lever, when not in a detented position, will automatically return to HOLD when released. The boom will remain stationary in the position that it is in when the lever is placed in HOLD.

**Lower (C, Fig. 6)**

Push the lever part way forward to lower the boom. The lever will automatically return to the HOLD when released.

**Float (D, Fig. 6)**

Push the lever all the way forward for this position. This position is detented so the lever must be pulled back manually to the HOLD position. FLOAT position allows the bucket to follow the contour of the ground.

**BUCKET CONTROL LEVER (Fig. 7)**

The bucket control lever is closer to the operator at the right of the operator's seat. The lever's three positions are: DUMP, HOLD and ROLL BACK.

**Roll Back (A, Fig. 7)**

To roll back the bucket pull the control lever back. The lever will return to HOLD automatically when released and stop the roll back motion of the bucket.

**Hold (B, Fig. 7)**

The bucket will stay in the position it is in when the lever is in the HOLD position.

**Dump (C, Fig. 7)**

To dump the bucket push the lever forward. When the lever is released it will automatically return to HOLD.

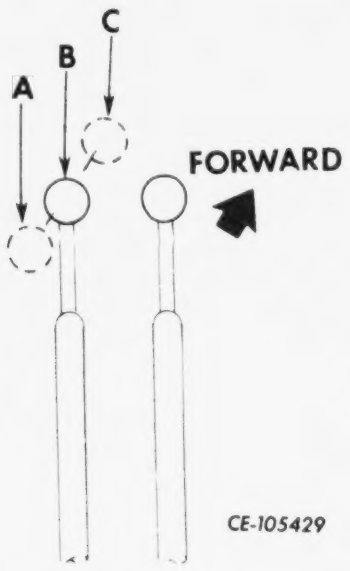



**Fig. 7. Bucket Control Lever Positions**

A. ROLL BACK
B. HOLD
C. DUMP

**BOOM STOP POSITIONER (Fig. 8)**

The boom is equipped with an air operated stop positioner system. The system will automatically stop the boom to any preselected position of its raising arc. Fig. 8 illustrates the control system and its component parts.

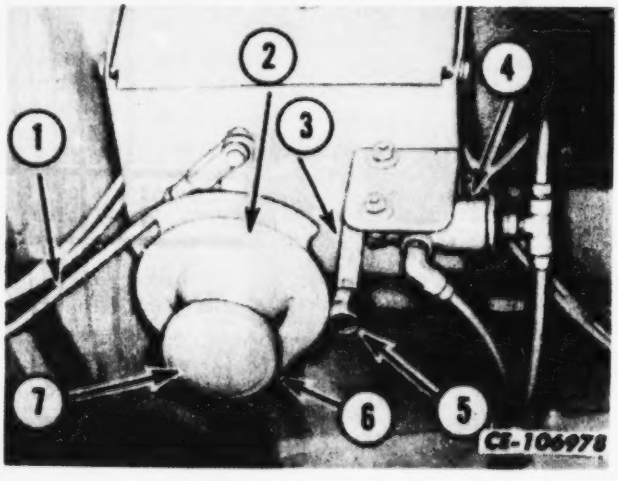



**Fig. 8. Boom Stop Positioner**

1. Control Rod
2. Cam Plate
3. Air Valve Actuating Lever
4. Air Valve
5. Cam Follower
6. Cam Lobe
7. Adjusting Knob

A rod (1) is connected to the boom arm and the positioner control cam plate (2). When the boom control lever is pulled all the way back into the detented RAISE position, the rod (1) moves back and turns the cam plate (2) as the boom raises. The cam follower(s) on the actuating lever (3) follows the cam surface. When the follower contacts the cam lobe (6), the actuating lever (3) upsets the system control valve (4). Compressed air from the machine's air system passes from the brake treadle valve through the upset air valve (4) and into the boom control spool of the main hydraulic valve. The compressed air acts against a piston in the spool assembly. The air pressure on the piston overcomes the detent plunger spring pressure and the spool centering spring returns the spool and boom control lever to the HOLD position.

### AUTOMATIC BUCKET POSITIONER (If Equipped)

The automatic bucket positioner, which is attached to the bucket cylinder, is factory pre-set to keep the bucket in a horizontal or "digging" position, with the cutting edge of the bucket parallel to the ground.

The object of the bucket positioner is to cause the bucket to return to its proper digging position automatically after its load has been dumped and the loader is returning to the work area. After dumping, move the bucket control lever into its detented ROLL-BACK position. When the bucket reaches its pre-set position, it automatically stops, and the bucket lever moves into its HOLD position.

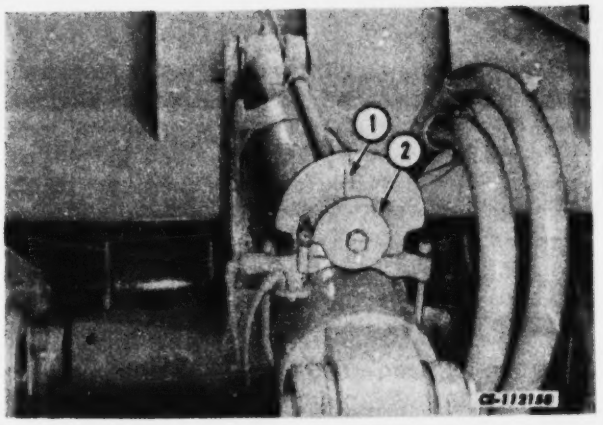



**Fig. 9. Automatic Bucket Positioner**

1. Indicator 2. Cam

**Adjustment (Fig. 9)**

To adjust the positioner for a different bucket attitude, loosen the bolt securing the activating cam (2). Move the bucket to the desired altitude. Turn the cam until the cam follower on the air valve actuating arm is at the point in the rise of the cam where the air valve is actuated. Tighten the bolt to secure the cam in place.

## STOPPING THE MACHINE

**NOTE:** *Step numbers correspond with the numbers shown on Fig. 10.*

1. Fully release the accelerator pedal.

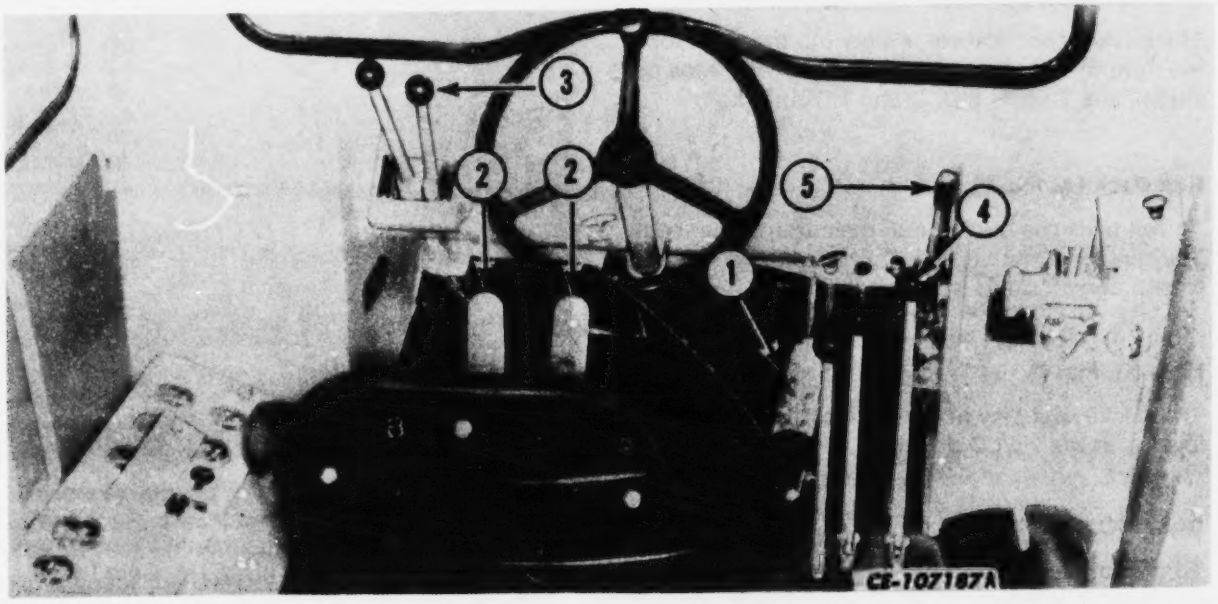



**Fig. 10. Stopping the Machine**

# OPERATING THE MACHINE

2. Apply the brake pedal or the brake and transmission disconnect pedal until the machine comes to a complete stop.

**CAUTION! Do not use the brake and transmission disconnect pedal when traveling at a fast speed or when going downhill.**

**CAUTION! Do not fan the brakes by repeatedly depressing and releasing the brake pedal. This can reduce air pressure too low for braking.**

3. Move the transmission direction lever to the neutral position (N).

**NOTE:** *The transmission can remain in gear if the machine is brought to a temporary stop and the operator does not leave the operator's compartment.*

4. Lower the bucket to the ground.

2. Apply the parking brake.

### AUTOMATIC BRAKE APPLY SYSTEM

The machine is equipped with an "automatic brake apply system" which has a separate, protected, brake system for each axle. Under normal operating conditions, both braking systems work together and are controlled by either one of the two treadle valves in the operator's compartment.

As the term "automatic brake apply system" implies, the regular service brakes will be applied automatically under certain emergency conditions. These conditions are described below.

Working in conjunction with the "automatic brake apply system" is an audible warning device (buzzer). Whenever the air pressure in the wet air reservoir is 414 kPa (60 psi) or less the buzzer will sound warning the operator of low air pressure in the wet reservoir (and/or low air pressure in one, or both, of the service air reservoirs). This buzzer warning will give the operator time to prepare for an involuntary stop.

**CAUTION! If the low air pressure warning buzzer sounds, stop the machine immediately, apply the parking brake, investigate and correct the cause of the low air pressure.**

Air loss, in most cases, would be limited to one section of the air brake system. Should the rear axle air system fail, the front axle system will continue to meter air pressure. In the event the front axle air section fails, controlling forces pass through the treadle valve and will continue to provide metered air pressure. Either one of these systems will continue to operate as long as air pressure is above 50-psi in the wet reservoir. Each service reservoir is protected by a check valve between it and the air supply (wet tank).

Should air pressure in the wet air reservoir drop to approximately 345 kPa (50 psi) the brakes will be applied automatically by the action of the emergency protection unit to stop and hold the machine. The brakes will remain applied until pressure in the wet reservoir again reaches approximately 414 kPa (60 psi).

Loss of air pressure in both of the service air reservoirs will not activate the "automatic brake apply system" and the machine will not have any service brakes.

## PARKING THE MACHINE

**CAUTION! Never leave the machine unattended while the engine is running.**

A few "DO"suggestions to protect both lives and equipment when parking.

DO park machine in area free of grease or fuel puddles which causes tire deterioration.

DO lower hydraulically supported loader equipment to the ground to reduce injury possibilities and to gain loader stability.

DO park machine on level ground, if at all possible.

a. To avoid unexpected movement.

b. To obtain accurate coolant, lubricant and fuel level checks.

DO park on level ground when possible. If necessary to park on slope, park at right angle, then secure with blocks (front and rear).

**NOTE:** *Parking on a steep slope is not recommended.*

## STOPPING THE ENGINE

**NOTE:** *Step numbers correspond with numbers shown on Fig. 11.*

1. Operate the engine at half throttle (no load) for three to five minutes.

**NOTE:** *Serious damage can result to the engine if the above step is neglected.*

2. Pull out and hold the engine shut-down handle until the engine stops. After the engine stops push the handle in.

3. Turn the ignition switch to the "OFF" position.

4. (Not illustrated.) Turn the electrical system master switch off.

**NOTE:** *When the machine is shut down at the end of the day or if the machine is to be left unattended, this switch may be locked by removing the key.*

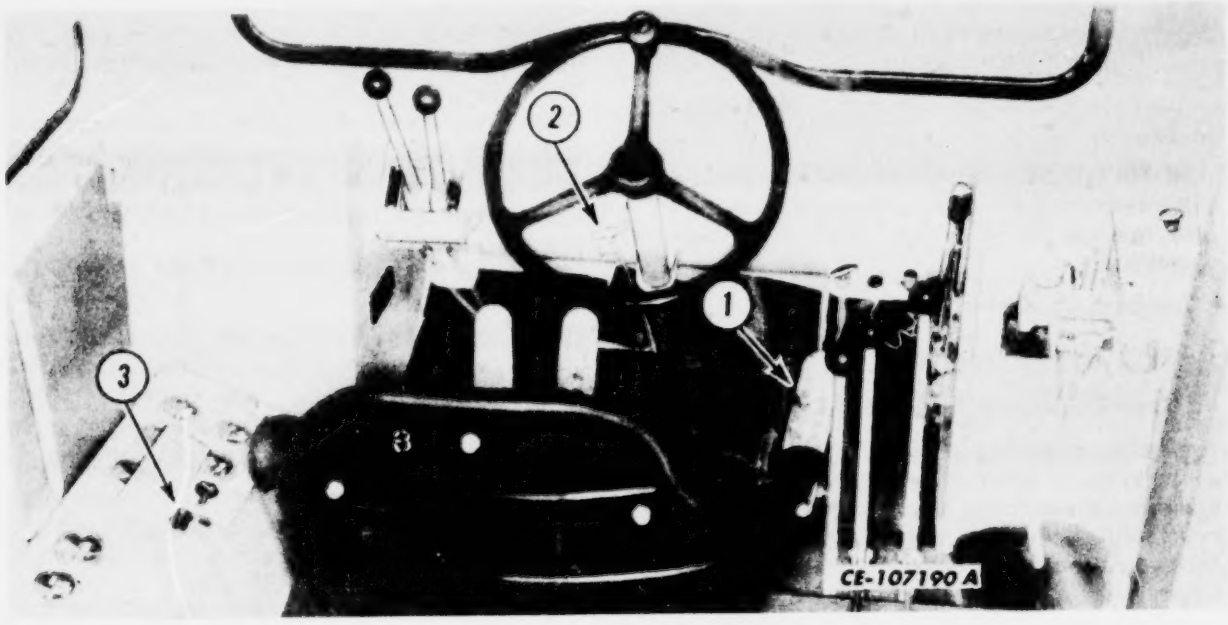



**Fig. 11. Stopping the Engine**

## GENERAL

Terrain, footing conditions, types of materials being worked and maneuvering space determine the speed at which the loader can function.

When the bucket is at work, keep the engine speed near full throttle and operate in the first (1) or second (2) gear transmission range. Use gear range two (2) and three (3) for traveling purposes.

The techniques for using the loader as described below are not intended to be all inclusive. Each work situation will vary. Loader operation may be altered for each particular application for best efficiency.

When possible, start all jobs from relatively level ground. If necessary, level an area large enough to provide sufficient working space. This prevents back and forth pitching of the loader and will result in easier operation.

Avoid wheel spin whenever possible; this wastes effort and only converts a relatively smooth working area into ruts and piles that pitch and tilt the loader. In cold weather, this matter can freeze and cause additional difficulty the following day.

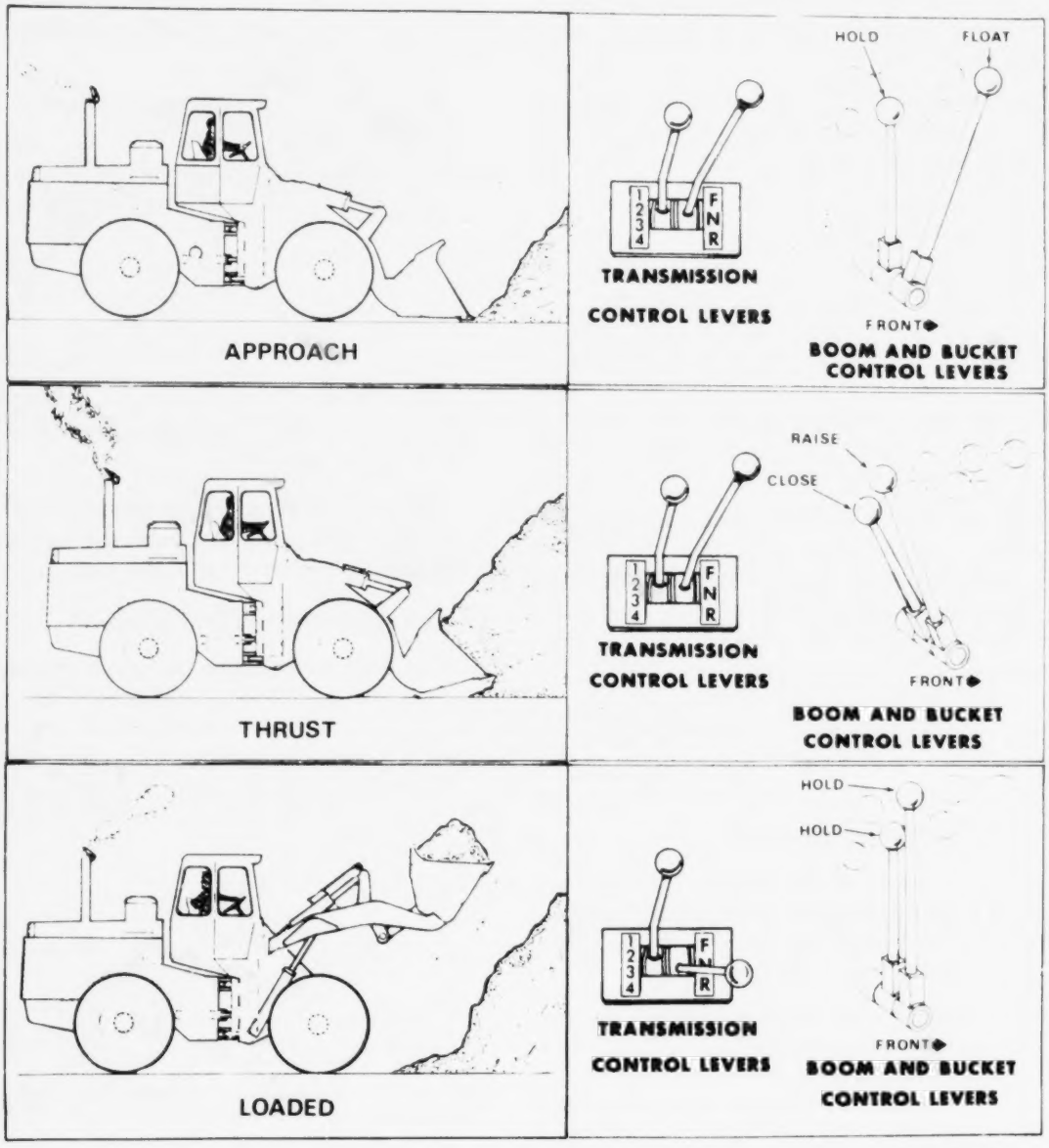



Fig. 1. Loading Sequence

# OPERATING TECHNIQUES

## BUCKET LOADING

Shift the transmission to low, forward and open the bucket.

To make maximum penetrations into the material to be moved, open the bucket until it is parallel with the ground and lower it to ground level. In this position the bucket cutting edge will meet with the least amount of resistance.

Once the bucket enters the material, pull the boom control lever up to "RAISE" and start closing the bucket. Operate the bucket control lever intermittently to "ROLL BACK" so the boom will raise at a nearly constant rate. Should the bucket penetrate so deep that the boom cannot raise properly, back away slightly.

It is necessary to operate the bucket control lever intermittently because the bucket hydraulic circuit over-rides the boom circuit.

Whenever the bucket circuit is in operation, hydraulic pressure in the boom circuit is cut off.

Digging in hard material can be aided by "wiggling" the bucket edge immediately after penetration. Operate the bucket control lever alternately between its "ROLL BACK" and "DUMP" positions. This action will loosen the material and improve bucket loading. Coordinated operation of the two hydraulic control levers as the bucket enters the material will yield satisfactory bucket loads.

Shift the boom lever to "HOLD" once the bucket has been filled. Back the loader away from the loading site and lower the bucket to within two feet of ground level. Carry the bucket near the ground to provide better transporting stability.

**NOTE:** *The boom assembly need not be fully raised to load the bucket. Maximum bucket loading will be obtained before the bucket reaches operator eye level.*

## TRANSPORTING LOADS

Transport loads close to the ground. If it is necessary to carry the bucket raised in transit, the operator should use increased caution. Perform all steering and shifting as smoothly as possible.

The speed used to transport loads should be relative to the bucket carry position and the type route used. Safety should be considered at all times. Carry the bucket low and closed. Travel slow anytime a load is carried over rough and/or sloping footing. A loaded bucket should never be transported with the boom fully raised.

Use the lower transmission speed range for bucket loading and the transportation of loads. The higher speed range may be used for making return trips to the loading sites. Carry the bucket low at high road speeds.

## FILLING A TRENCH (Fig. 2)

Fill trenches or excavations by pushing or unloading material into the area to be filled with the machine at a 90° angle to line of the fill area. Pile material a little higher than ground level to allow for settling.

**Fig. 2. Filling a Trench**

**CAUTION! Keep the machine wheels a safe distance from the opening's edge while working in the area.**

## ROCK LOADING (Figs. 3 and 4)

Load small, loose rocks first. Dislodge large firmly fixed rocks by first digging around and underneath the rock with the bucket. When enough earth has been removed from around the rock, lift the boom with the center of the bucket under one end of the rock, this should loosen it enough to be removed.

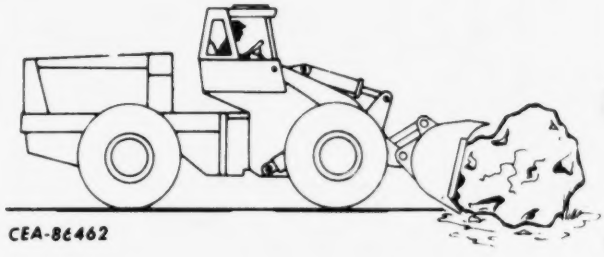



**Fig. 3. Loading Large Rock**

Put enough loose rock or dirt into the truck first to act as cushioning material, before proceeding to load larger rocks. Place large rocks into center of truck from as low a height as possible.

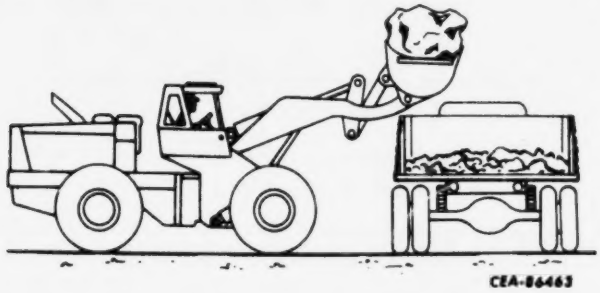



**Fig. 4. Dumping Large Rock**

Lower loaded or unloaded bucket to ground when waiting for any length of time.

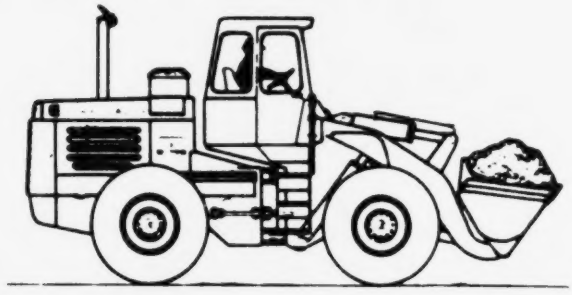



**Fig. 5. Transporting a Load**

Always operate loader at speeds slow enough to insure complete operator control. When traveling, carry bucket low to obtain maximum visibility.

Keep work area as clean and level as possible to insure more efficient and smoother operation.

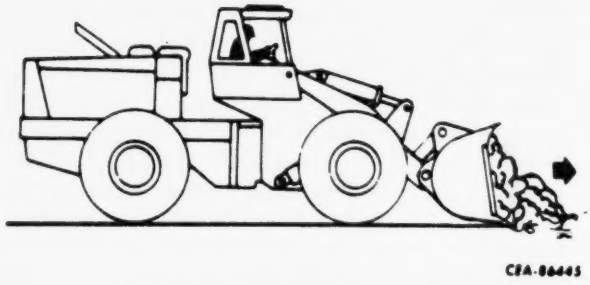



**Fig. 6. Machine Work Area**

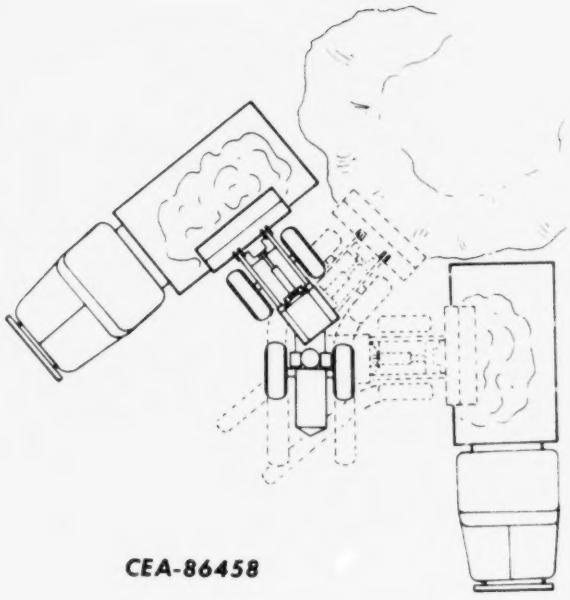



**Fig. 7. V-Method of Loading**

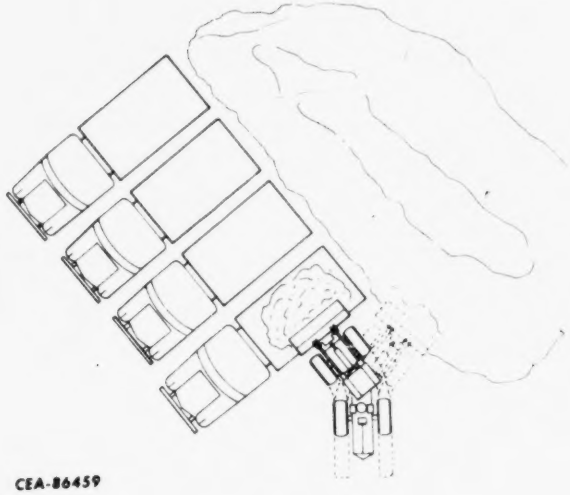



**Fig. 8. Step Loading**

## DUMPING INTO A TRUCK OR HOPPER

When dumping into a truck or bin, raise the bucket so that it clears the top edge safely, and then move the tractor forward so the bucket is within the dumping area. Apply the extreme left brake treadle. Position the boom control lever in "HOLD". Push the bucket control lever slowly forward. This will cause the bucket to spill its load. Dumping the load slowly will ease the shock of suddenly adding weight to the truck or receptacle.

# OPERATING TECHNIQUES

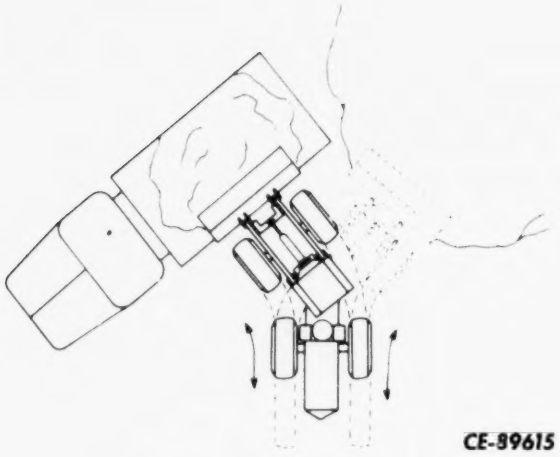



**Fig. 9. Loading a Truck**

After discharging load, operate bucket control lever to close bucket. Use only enough pressure to activate the control valve. When the bucket reaches the preset position it will kick out and stop the bucket.

1. If hopper or car is higher than maximum reach of machine, build a ramp.

2. Move loader to hopper and raise boom to clear sides. Set boom positioner control at proper height.

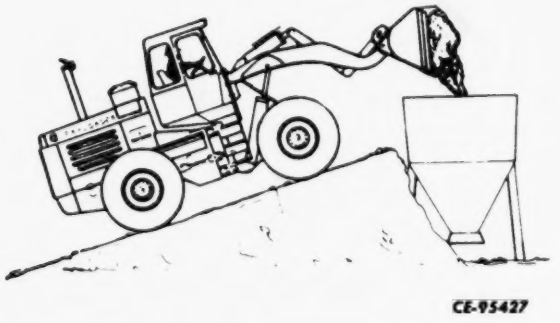



**Fig. 10. Hopper Loading**

3. Load bucket as outlined in this section. Try to maintain stock pile as close to hopper as possible. With bucket loaded approach hopper raising boom during approach.

4. Boom will raise to proper height and stop. Open bucket to dump into hopper, close bucket while reversing, and return to stock pile for new load.

**NOTE:** *Never travel forward with the bucket in a complete open position on the ground. Serious damage to loading mechanism can result.*

### DUMPING INTO TRUCK BODY (Fig. 11)

1. Approach truck with bucket raised to clear truck body.

2. As bucket moves over body, move bucket control lever to "DUMP" position.

3. Continue dumping bucket and raising boom until bucket is empty.

4. Move bucket control lever to "ROLL BACK" position until bucket positioner stops the bucket. Keep bucket raised above truck body, and back loader away from truck.

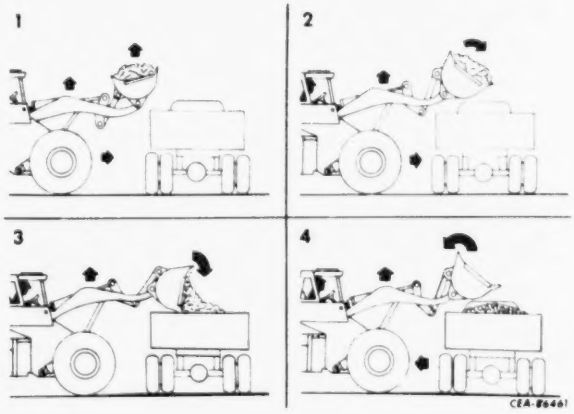



**Fig. 11. Dumping Into Truck Body**

### DIGGING OR EXCAVATING

When digging or excavating, level the bucket with the ground. Use the boom control lever to force the bucket cutting edge into the ground as the loader moves forward. If the cutting edge does not penetrate the ground immediately, use the bucket control lever to incline the angle of the cutting edge slightly to give better penetration. As the cutting edge penetrates, use the bucket control lever to adjust the bucket cutting depth to prevent excessive penetration. Manipulate the boom and bucket control levers slightly to maintain as good a grade as possible. When maintaining a grade, drive the loader in low gear at about half throttle to make an accurate cut. When the bucket is full, tip the bucket back and raise it to clear the ground. Carry the load to the desired dump area.

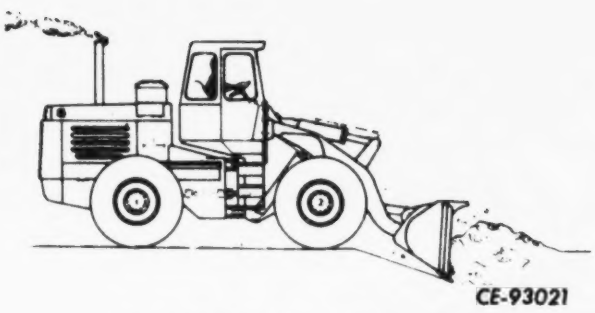



Fig. 12. Digging or Excavating

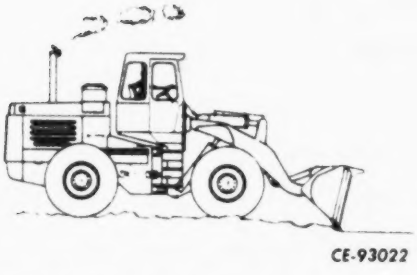



Fig. 13. Backdragging or Leveling

### BACKDRAGGING OR LEVELING

When backdragging or leveling, keep the bucket cutting edge level with the ground as the loader is moved backward. Lift the bucket off the ground when moving forward to begin a new drag so it will not cut in.

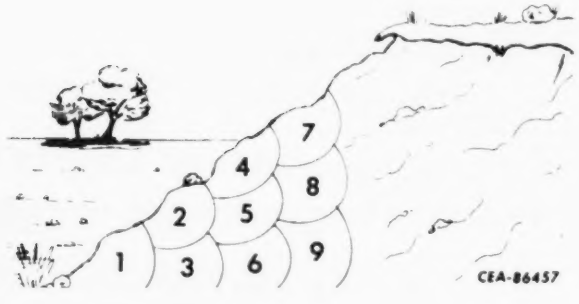



Fig. 14. Pile Loading Steps

Above is a recommended method of removing material from an embankment.

Fig. 15. Avoid Overhangs

Do not operate too close to an overhang or deep ditch. Use adequate protection and caution when working on steep slopes.

### EXCAVATING

When digging or excavating in hard material, penetrate with bucket edge. Immediately after penetration, agitate bucket by moving bucket control lever between "ROLL BACK" and "DUMP" positions. This action will loosen material and allow use of boom control to lift bucket, and continue to loosen material. Fill bucket, roll back and raise to transport material to dumping area.

### REMOVING SMALL TREES (Fig. 17)

Small or average size trees can be removed by centering bucket and raising to eye level.

Push tree gently before applying full power. Push tree over and back loader away. Lower bucket and push tree from area.

### REMOVING LARGE TREES (Fig. 18)

To remove large trees, make cuts around tree weakening the tree roots. After the cut is done, fill one side of cut to allow the loader to approach the tree. Push tree, with bucket at eye level, until tree starts to fall.

Back loader away. Approach root section, position bucket under roots and push tree from area.

# OPERATING TECHNIQUES

Fig. 16. Leaving Excavation

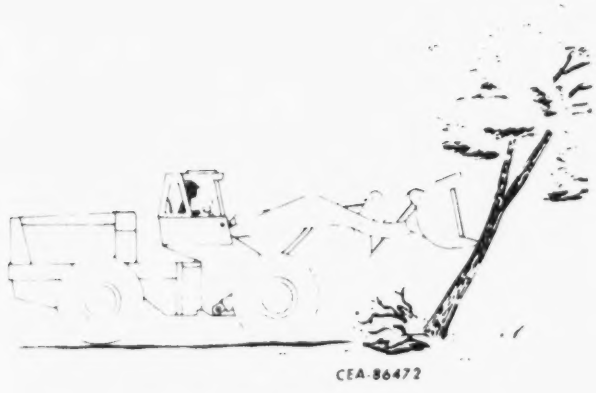



Fig. 17. Removing Small Trees

Fig. 18. Clearing Large Trees

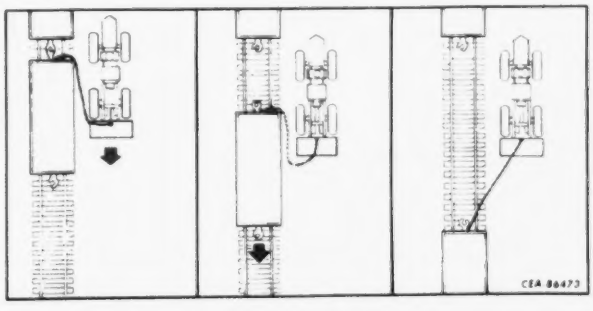



Fig. 19. Moving Railroad Cars

## MOVING RAILROAD CARS

1. Attach cable to car coupler and to welded hook on loader bucket.
2. Station man on car to operate car brakes.
3. Keep loader close to car as possible and move car.
4. Car will be difficult to place in motion but much harder to stop.
5. Avoid excessive speed. Allow car to coast ahead of loader to keep the two cable tight.
6. Bring car to a smooth stop with the loader and brakes.

# SCHEDULED MAINTENANCE



Scheduled maintenance is the normal maintenance necessary to provide proper and efficient equipment operation. To protect your investment and prolong the service life of your equipment, follow the scheduled maintenance listed below.

## SCHEDULED MAINTENANCE GUIDE

### Every 10 Hours of Operation

| | |
|---|---|
| Air cleaner service indicator | Check indicator. Refer to "AIR CLEANING SYSTEM" in Section 8. |
| Wheel lug nuts | Check torques until torques stabilize. Refer to "SPECIAL TORQUES" in Section 9 |
| Alcohol evaporator (if equipped) | Fill. Refer to "ALCOHOL EVAPORATOR" in Section 8 |
| Pre-cleaner hood and dust vacuator valve | Clean. Refer to "AIR CLEANING SYSTEM" in Section 8. |
| Tires | Check inflation pressure. Refer to "SPECIFICATIONS" in Section 8. |
| Scheduled lubrication | Refer to "SERVICE GUIDE" in this section. |

### Every 50 Hours of Operation

| | |
|---|---|
| Cab heater air cleaner (if equipped) | Clean. Refer to "AIR CLEANING SYSTEM" in Section 8. |
| Scheduled lubrication | Refer to "SERVICE GUIDE" in this section. |

### Every 100 Hours of Operation

| | |
|---|---|
| Engine cylinder head | Initial torquing. Refer to "ENGINE CYLINDER HEAD" in Section 8. |
| Hydraulic reservoir filters | Initial change. Refer to "HYDRAULIC SYSTEM" in Section 8. |
| Hydraulic reservoir breather | Clean. Refer to "HYDRAULIC SYSTEM" in Section 8 |
| Service brake power cluster breathers | Clean. Refer to "BRAKES" in Section 8. |
| Transmission filter | Initial filter element change. Refer to "TRANSMISSION" in Section 8. |
| Wheel lug nuts | Check torques. Refer to "SPECIAL TORQUES" in Section 9. |
| Transmission breather | Clean. Refer to "TRANSMISSION" in Section 8 |
| Scheduled maintenance | Refer to "SERVICE GUIDE" in this section. |

# SCHEDULED MAINTENANCE

## Every 200 Hours of Operation

| | |
|---|---|
| Air system | Check for and correct leaks. Refer to "AIR PRESSURE SYSTEM" in Section 8. |
| Alternator | Clean. Refer to "ELECTRICAL SYSTEM" in Section 8. |
| Belts | Check tension and replace if necessary. Refer to "BELTS" in Section 8. |
| Crankcase breather | Clean. Refer to "AIR CLEANING SYSTEM" in Section 8. |
| Engine lubricating oil filters | Replace. Refer to "ENGINE LUBRICATING OIL FILTERS" in Section 8. |
| Service brakes | Check for wear. Refer to "BRAKES" in Section 8. |
| Stop light switch | Check operation. Refer to "ELECTRICAL SYSTEM" in Section 8. |
| Wiring | Check for worn, cracked or frayed insulation, broken wires, loose or corroded connections. |
| Scheduled lubrication | Refer to "SERVICE GUIDE" in this section. |

## Every 500 Hours of Operation

| | |
|---|---|
| Fuel tank | Drain water. Refer to "FUEL SYSTEM" in Section 8. |
| Machine (general) | Clean. Refer to "CLEANING THE MACHINE" in Section 8. |
| Transmission filter and strainer | Change filter element and clean strainer. Refer to "TRANSMISSION" in Section 8. |

## Every 1000 Hours of Operation

| | |
|---|---|
| Cooling system | Clean. Refer to "COOLING SYSTEM" in Section 8. |
| Parking brake | Adjust. Refer to "BRAKES" in Section 8. |
| Control levers | Lubricate pivot points. Apply lubricator until clean grease appears. |
| Scheduled lubrication | Refer to "SERVICE GUIDE" in this section. |

## Every 2000 Hours of Operation

| | |
|---|---|
| Engine valves | Check clearance. Refer to "ENGINE VALVE CLEARANCE ADJUSTMENT" in Section 8. |

## Every 5000 Hours of Operation

| | |
|---|---|
| Engine cranking motor | Lubricate. Refer to "ELECTRICAL SYSTEM" in Section 8. |

**Periodic**

| | |
|---|---|
| Air cleaner elements | Clean or change when the air cleaner service indicator shows completely red. Refer to "AIR CLEANING SYSTEM" in Section 8. |
| Ether injector can (if equipped) | Replace whem empty. Refer to "ETHER INJECTOR" in Section 8. |
| Fuel filters | Change according to fuel oil pressure gauge or when loss of engine power or misfiring is evident. Refer to "FUEL SYSTEM" in Section 8. |
| Main frame center hinges | Check center hinge adjustment and adjust when necessary to prolong the life of the center hinge bushings. Refer to your PayLine Distributor. |
| Oil pump screen | Clean whenever oil pan is removed. |
| Seat belt | Inspect. Refer to "SEAT BELT" in Section 8. |
| Service brakes | Bleed system. Refer to "BRAKES" in Section 8. |

## LUBRICATION

For information about the lubrication of a new loader, refer to "LUBRICATION WHEN SHIPPED" in Section 2.

The life and performance of a loader depends on the care that it is given, and proper lubrication is an important maintenance service for your loader.

Thorough lubrication service performed at definite intervals will aid greatly in prolonging the life of the loader and in reducing operating expense.

The type of work being done, load, ground and weather conditions are all factors to consider in frequency of lubrication. The scheduled intervals between lubrication periods shown on the "SERVICE GUIDE" are approximate, being based on average operating conditions.

### SELECTION OF LUBRICANTS

It may be necessary to lubricate after shorter working periods under severe operating conditions such as extremely dusty conditions, low engine temperatures, intermittent operation, excessively heavy loads with high oil temperatures, or when diesel fuel with a high sulphur content is used. However, the time intervals between lubrication periods must never exceed those indicated in this manual.

The selection of the proper type (specification) the grade (weight or viscosity) of lubricant is not guess work. Many tests have been made to determine the correct lubricants for this loader.

#### Lubricant Viscosities

During cold weather, base the selection of a crankcase lubricating oil viscosity on the lowest anticipated temperature for the day to make starting easier. For hot weather operation, base the selection on the highest anticipated temperature. Refer to the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section.

## LUBRICANT SPECIFICATIONS AND CAPACITIES

It is not the policy of the International Harvester Company to approve lubricants or to guarantee oil performance in service. The responsibility for the quality of the lubricant must remain with the supplier of the lubricant. When in doubt, consult your PayLine Distributor. The lubricants specified for this tractor are shown in the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section.

# SCHEDULED MAINTENANCE

**LUBRICANT SPECIFICATIONS AND CAPACITIES CHART**
**LUBRICANT KEY: EO** — Engine Oil **MPG** — Multi-Purpose Grease **MPL** — Multi-Purpose Lubricant

| LUBRICATION POINT | CAPACITY | ANTICIPATED AIR TEMPERATURES | | |
|---|---|---|---|---|
| | | **+49°C to -7°C (+120°F to +20°F)** | **+21°C to -23°C (+70°F to -10°F)** | **-12°C to -34°C (+10°F to -30°F)** |
| Crankcase w/Filters | 30.3 litres (32 qts) | **EO** — I.H. No. 1 Engine Oil or API CD/CC or CD or MIL-L-2104C or MIL-L-45199B Oils | | |
| | | SAE-30 | SAE-10W | SAE-10W diluted w/10% kerosene |
| Hydraulic Reservoir | 208.2 litres (55 gals) | **EO** — I.H. No. 1 Engine Oil or API CD/CC, CD, CC/SE or MIL-L-45199B or MIL-L-2104B or C or MIL-L-46152 Oils | | |
| | | SAE-10W (*) | SAE-10W | SAE-10W diluted w/10% kerosene |
| Transmission w/Filters | 42.5 litres (45 qts) | I.H. Smooth Shift Dexron® | | |
| Axles (Each) | 42.5 litres (45 qts) | **MPL** — I.H. 135H EP Gear Lubricant or API-GL-5 or MIL-L-2105C Gear Lubricant | | |
| Intermediate Drive Block | 0.47 litre (1 pt) | SAE-85W-140 | SAE-80W-90 or 85W-140 | SAE-80W-90 (#) |
| Service Brake Power Clusters (Each) | Fill as instructed | I.H. Super Heavy Duty or SAE-J1703E Brake Fluid | | |
| All Lubrication Fittings | Fill as instructed | **MPG** — I.H. Super Grease or I.H. 251H EP | | |
| Steering Gear Housing | Fill as instructed | **MPL** — I.H. 135H EP Gear Lubricant, API GL-5 or MIL-L-2105B Gear Lubricant | | |
| | | SAE-85W-140 | SAE-80W-90 or 85W-140 | SAE-80W-90 (#) |

(*) For ambient temperature constantly above +21°C (+70°F), a SAE-20W-20 may be used.

(#) Channel point must not exceed -34°C (-30°F) for SAE-80W-90 grade gear lubricants when they are used below -23°C (-10°F).

# SCHEDULED MAINTENANCE

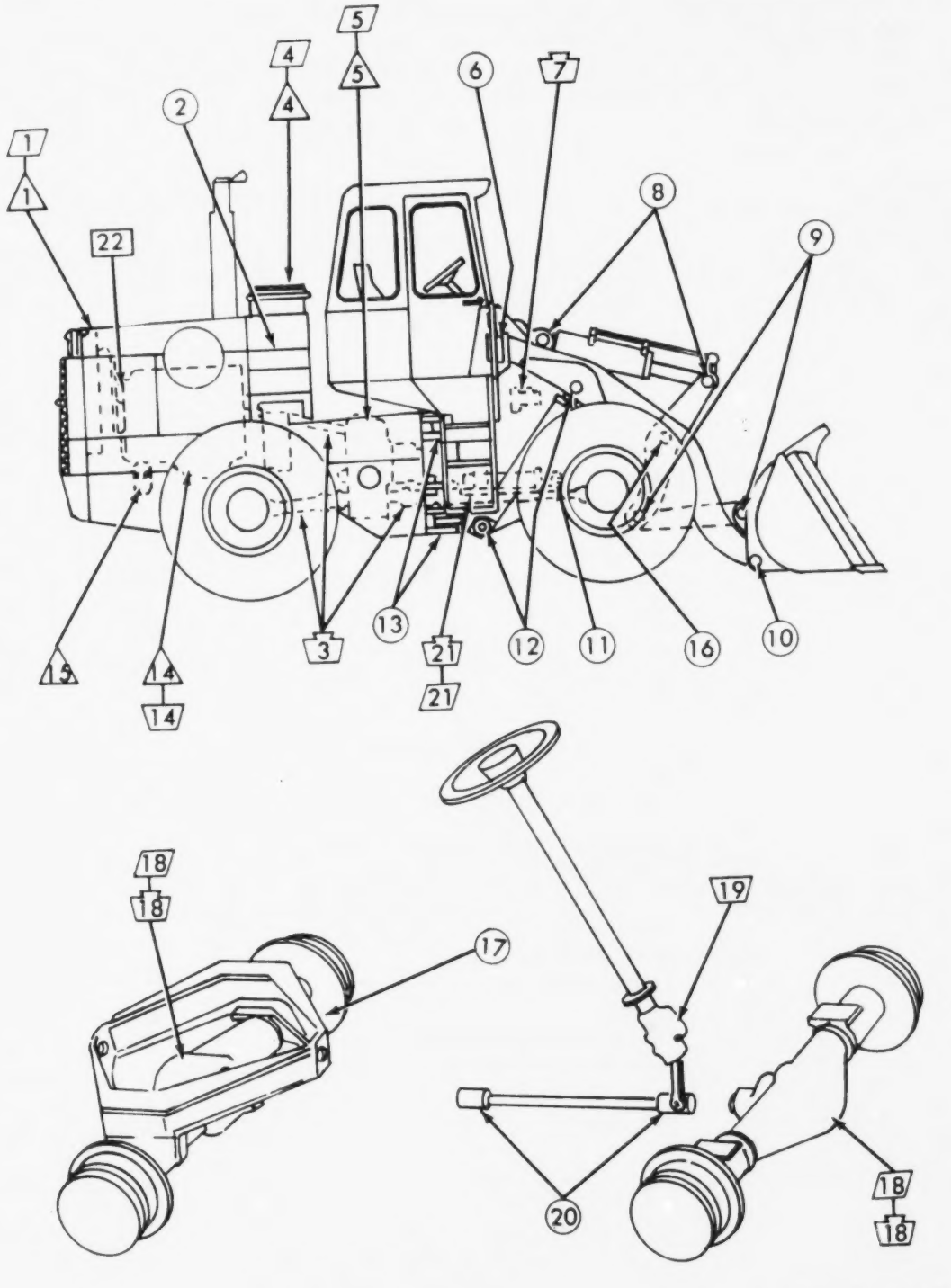
## SERVICE GUIDE

**NOTE:** *Points of service are individually explained under "SERVICE POINTS." They are identified by item numbers corresponding with those listed in the chart below and the machine diagram. Always use clean lubricators and containers. Wipe dirt from fittings before fresh grease is added. Use the service recorder to determine service intervals.*

| SERVICE INTERVAL | ITEM NO. | POINT OF SERVICE | LUBRICANT | REMARKS |
|---|---|---|---|---|
| Every 10 Hours △ | 1 | Radiator Coolant | ——— | Check |
| | 4 | Hydraulic Reservoir Oil | EO | Check |
| | 5 | Transmission Oil | ——— | Check |
| | 13 | Articulation Pivots | MPG | Grease |
| | 14 | Engine Crankcase Oil | EO | Check |
| | 15 | Fuel Tank | ——— | Fill |
| Every 50 Hours ○ | 2 | Batteries | ——— | Check |
| | 6 | Boom Pivots | MPG | Grease |
| | 8 | Bucket Cylinder | MPG | Grease |
| | 9 | Bucket Link | MPG | Grease |
| | 10 | Bucket Pivots | MPG | Grease |
| | 11 | Steering Cylinders | MPG | Grease |
| | 12 | Boom Cylinders | MPG | Grease |
| | 16 | Bellcrank Pivots | MPG | Grease |
| | 17 | Axle Cradle | MPG | Grease |
| | 20 | Drag Links | MPG | Grease |
| Every 100 Hours | 3 | Drive Shafts | MPG | Grease |
| | 7 | Service Brake Power Clusters | ——— | Check |
| | 18 | Axles | MPL | Check |
| | 21 | Intermediate Drive Block | MPL | Check |
| Every 200 Hours | 14 | Engine Crankcase Oil | EO | Change |
| | 19 | Steering Gear Lubricant | MPL | Check |
| Every 1000 Hours | 1 | Radiator Coolant | ——— | Change |
| | 4 | Hydraulic Reservoir Oil | EO | Change |
| | 5 | Transmission Oil | ——— | Change |
| | 18 | Axles | MPL | Change |
| | 21 | Intermediate Drive Block | MPL | Change |
| Every 500 Hours □ | 22 | Fan Hub | MPG | Grease |

# SCHEDULED MAINTENANCE

## SERVICE GUIDE



## SERVICE POINTS

### ITEM 1 — RADIATOR COOLANT

**Checking Coolant Level**

Refer to "COOLING SYSTEM" in Section 8.

**Changing Coolant**

Drain, clean and refill. Refer to "COOLING SYSTEM" in Section 8.

### ITEM 2 — BATTERIES

Check liquid level, terminal tightness and clean batteries. Refer to "ELECTRICAL SYSTEM" in Section 8.

### ITEM 3 — DRIVE SHAFTS

Prior to applying the lubricator to a fitting, wipe the fitting clean to prevent dirt from entering. Apply lubricator to each fitting until clean grease appears.

**Transmission to Rear Axle**

(Three fittings.) Fittings are located at each end of the drive shaft and one in the slip tube.

**Torque Converter to Transmission**

(Three fittings.) Fittings are located at each end of the drive shaft in the spider and one in the slip tube.

**Transmission to Intermediate Block**

(Three fittings.) Fittings are located at each end of the drive shaft in the spider and one in the slip tube.

**Intermediate Block to Front Axle**

(Three fittings.) Fittings are located at each end of the drive shaft in the spider and one in the slip tube.

### ITEM 4 — HYDRAULIC RESERVOIR OIL

**Checking Oil Level**

**CAUTION! Always lower the bucket to the ground before servicing the hydraulic system. Loosen the reservoir filler cap slowly to relieve the pressure in the system.**

1. While the hydraulic oil is at operating temperature, park the machine on level ground, completely lower the bucket, apply the parking brake and stop the engine.

2. Remove the filler cap and oil level gauge (Fig. 1) and check oil level. The oil should be at the full mark, or a little higher, on the gauge.

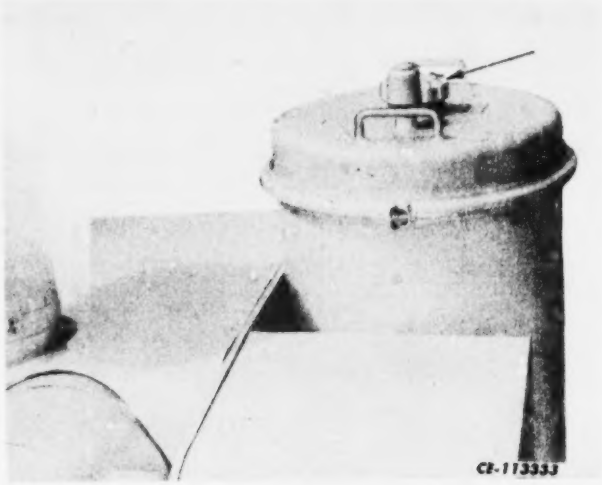



**Fig. 1**

3. If oil level is low add fresh oil as necessary. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section for grade of oil specified.

4. Install the filler cap and oil level gauge.

**Changing the Oil**

Drain the hydraulic system and refill with clean oil. Refer to "HYDRAULIC SYSTEM" in Section 8.

### ITEM 5 — TRANSMISSION OIL

**Checking Oil Level**

**CAUTION! Do not check the transmission oil level or add oil unless the machine halves are securely locked with the safety bar and pins provided. Have a second person at the machine controls while checking the oil.**

**NOTE:** *If transmission oil leakage is suspected or if the machine has been out of operation for a length of time check transmission oil level gauge with the machine cold and the engine off. Oil should appear on the gauge during this condition; if not add oil before proceeding to the following steps.*

1. Work the machine until the torque converter oil temperature gauge registers in the "RUN" (green) area. Make use of all transmission direction and gear ranges.

# SCHEDULED MAINTENANCE

2. Park the machine in a straight position on level ground.

3. Shift the transmission to "N" (neutral). Lower the bucket to the ground and apply the parking brake.

4. Stop the engine and install the safety bar.

5. Start the engine and let it run at low idle.

6. Turn the "T" handle of the transmission oil level gauge (Fig. 2) counterclockwise to loosen it.

Fig. 2

7. Remove the oil level gauge and wipe it clean.

8. Insert the oil level gauge back in the tube as far as it will go.

9. Remove the oil level gauge again and check the level. The correct level is between the "L" and "H" marks. If at or below the "L" mark, add enough oil to bring the level close to the "H" mark. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section for the grade of lubricant specified.

**NOTE:** *If the oil level is above the "H" mark, drain the oil level down to the "H" mark by removing the drain plug from the bottom of the transmission. Too much oil in the transmission will cause aeration of the oil.*

10. Install the oil level gauge and tighten.

**Changing the Oil**

Drain the transmission, clean the sump strainer and change the filter element. Refill with clean fluid. Refer to "TRANSMISSION" in Section 8.

**ITEM 6 — BOOM PIVOTS (Fig. 3)**

(One fitting in each boom arm.) Apply lubricator to each fitting until clean grease appears.

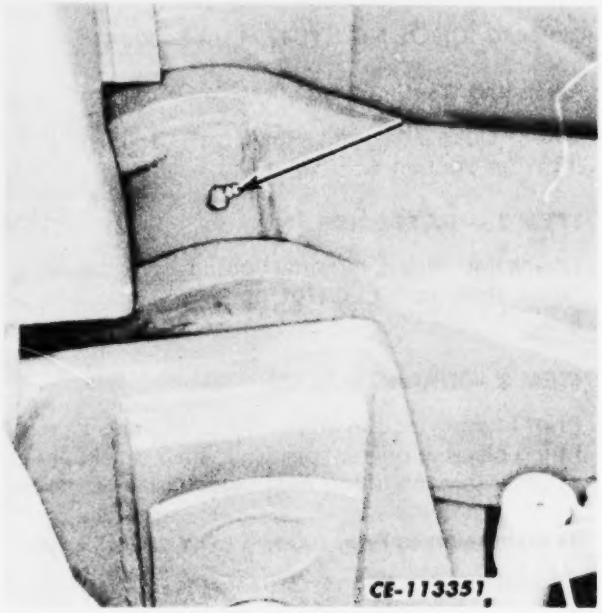



Fig. 3

**ITEM 7 — SERVICE BRAKE**

**Power Clusters**

Check power cluster fluid level. Refer to "BRAKES" in Section 8.

**ITEM 8 — BUCKET CYLINDER (Figs. 4 and 5)**

(Two fittings.) Apply lubricator to each fitting until clean grease appears.

Fig. 4

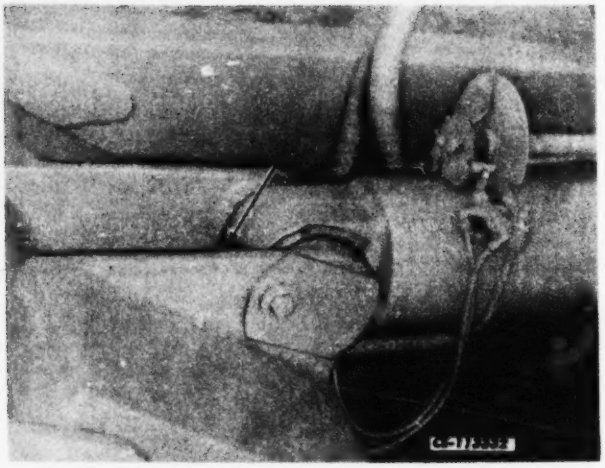


Fig. 5

**ITEM 9 — BUCKET LINK (Fig. 6)**

(Two fittings.) Apply lubricator to each fitting until clean grease appears.

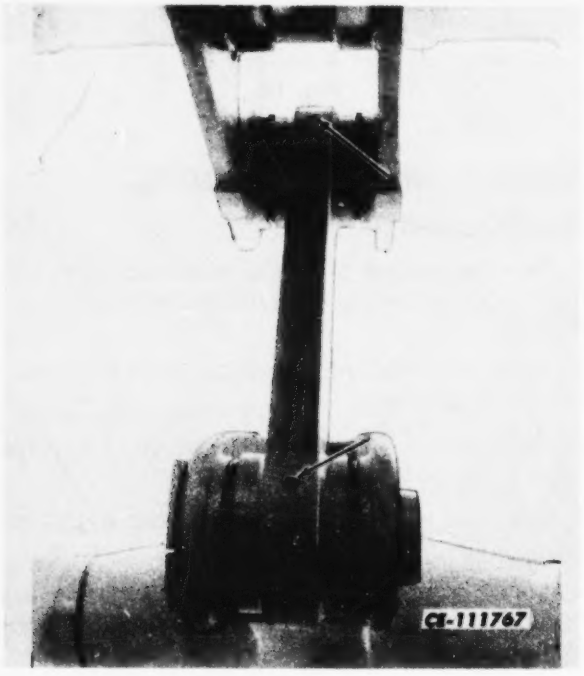



Fig. 6

**ITEM 10 — BUCKET PIVOTS (Fig. 7)**

(One fitting in each boom arm.) Apply lubricator to each fitting until clean grease appears.

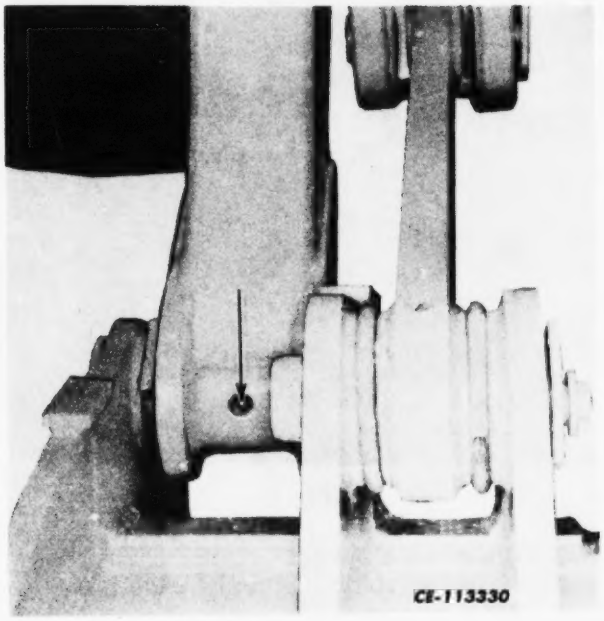



Fig. 7

**ITEM 11 — STEERING CYLINDERS (Figs. 8 and 9)**

(Two fittings in each cylinder.) Apply lubricator to each fitting until clean grease appears.

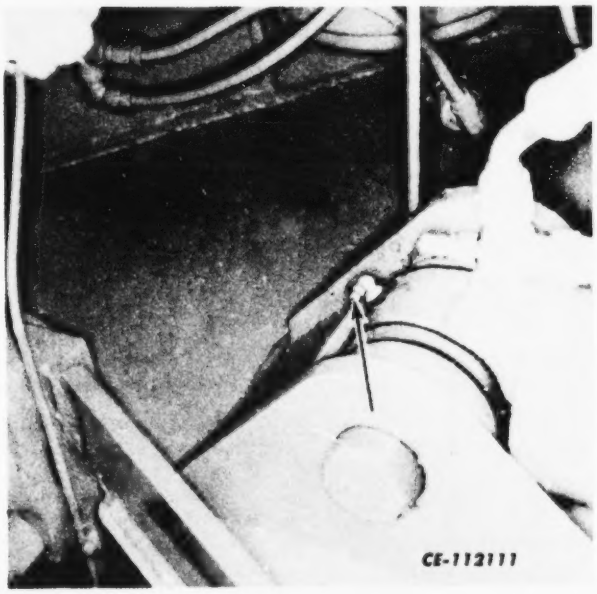



Fig. 8

# SCHEDULED MAINTENANCE

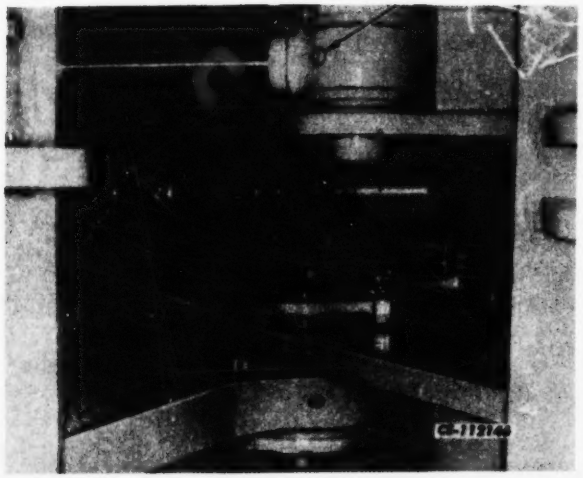


Fig. 9

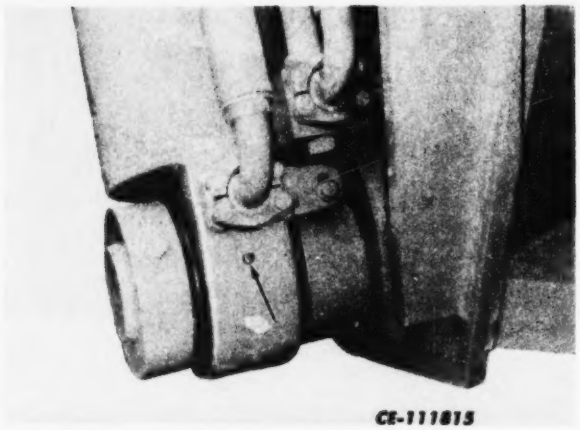



Fig. 10

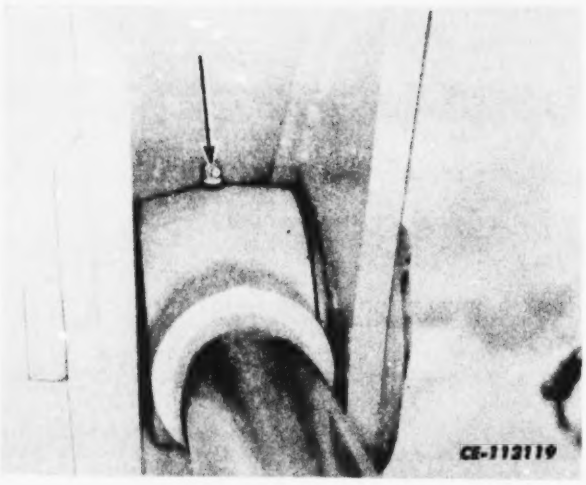



Fig. 11

**ITEM 12 — BOOM CYLINDERS (Figs. 10 and 11)**

(Two fittings in each cylinder.) Apply lubricator at each fitting until clean grease appears.

**ITEM 13 — ARTICULATION PIVOTS (Fig. 12)**

(Two fittings at each pivot point.) Apply lubricator at each fitting until clean grease appears.

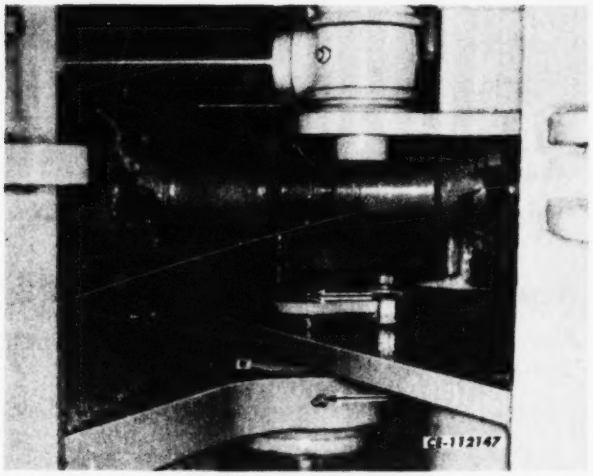



Fig. 12

**ITEM 14 — ENGINE CRANKCASE OIL**

**Check Oil Level**

1. Park the machine on level ground; apply the parking brake; completely lower the bucket; and stop the engine.

2. Allow 10 to 15 minutes for the oil to drain back into the crankcase.

3. Loosen the "T" handle of the gauge (1, Fig. 13), remove the gauge and wipe it clean.

4. Insert the gauge completely, but do not tighten.

5. Remove the gauge and check the oil level. If level is at or below the "L" (low) mark remove the filler cap (2) and add oil, through the filler pipe to bring the level up to the "H" (full) mark on the gauge.

6. Reinstall and secure the oil level gauge and filler plug.

**Changing the Oil**

Drain the engine crankcase, replace the filters and refill with clean oil. Refer to "ENGINE LUBRICATING OIL FILTERS" in Section 8.

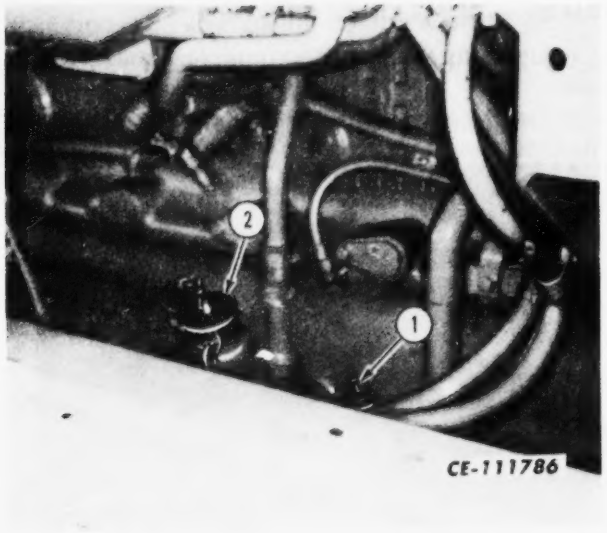



Fig. 13

1. Level Gauge 2. Filler Cap

**ITEM 15 — FUEL TANK (Fig. 14)**

Fill fuel tank with approved diesel fuel only. Refer to "FUEL SYSTEM" in Section 8 for fuel specifications.

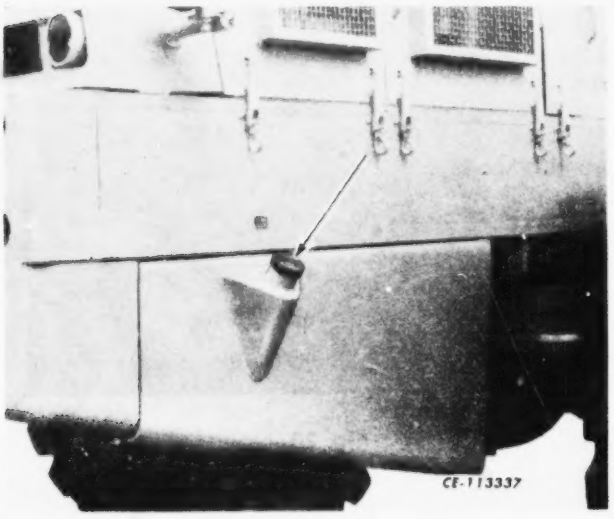



Fig. 14

**ITEM 16 — BELLCRANK PIVOT (Fig. 15)**

(Two fittings.) Apply lubricator to each fitting until clean grease appears.

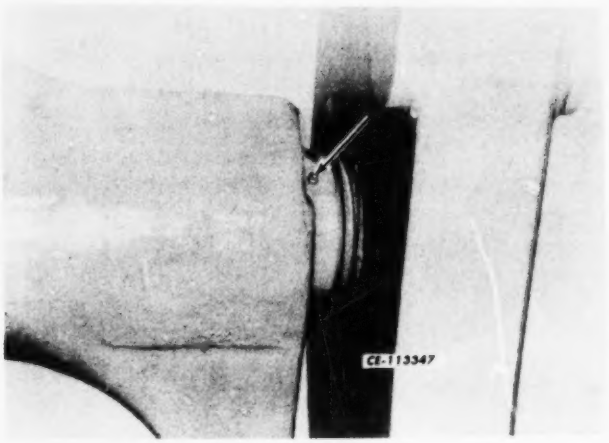



Fig. 15

**ITEM 17 — AXLE CRADLE (Fig. 16)**

Apply lubricator to each fitting until clean grease appears.

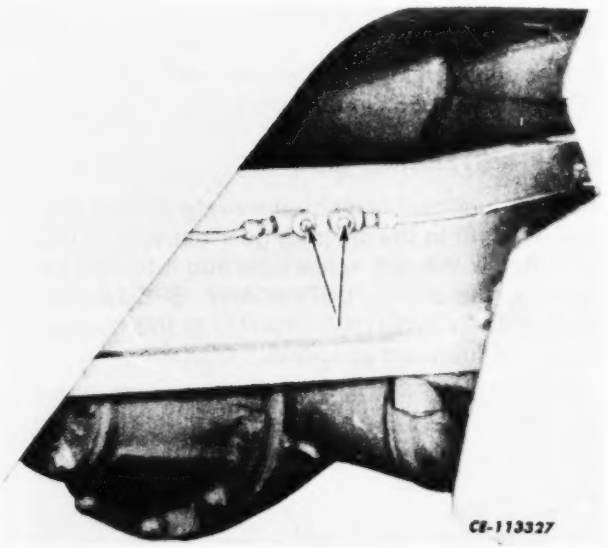



Fig. 16

**ITEM 18 — AXLES**

**Checking Oil Level (Fig. 17)**

**NOTE:** *Both the front and rear axles are checked in the same manner.*

1. While the lubricant is at operating temperature park the machine on level ground, completely lower the bucket, stop the engine and apply the parking brake.

# SCHEDULED MAINTENANCE

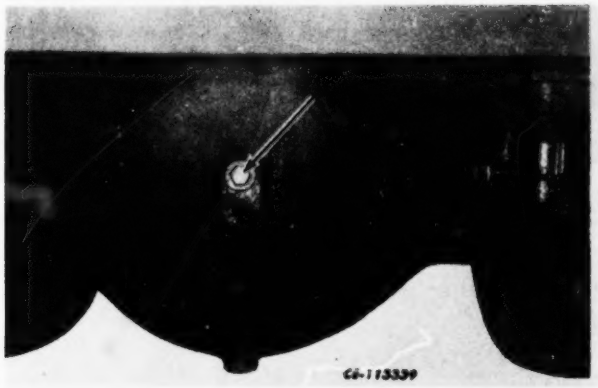


Fig. 17

2. Remove the filler and level check plug. If the lubricant is below the plug hole add lubricant as necessary to bring the level up to the bottom of the hole. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section for the grade of lubricant specified.

3. Install the filler and level check plug.

**Changing the Oil**

Drain the oil, clean the breathers and refill with clean oil. Refer to "AXLES" in Section 8.

**ITEM 19 — STEERING GEAR**

Check the lubricant level by removing the top cap screw (Fig. 18) in the steering gear housing. If the level is below the cap screw hole add lubricant as necessary. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section for grade of lubricant specified.

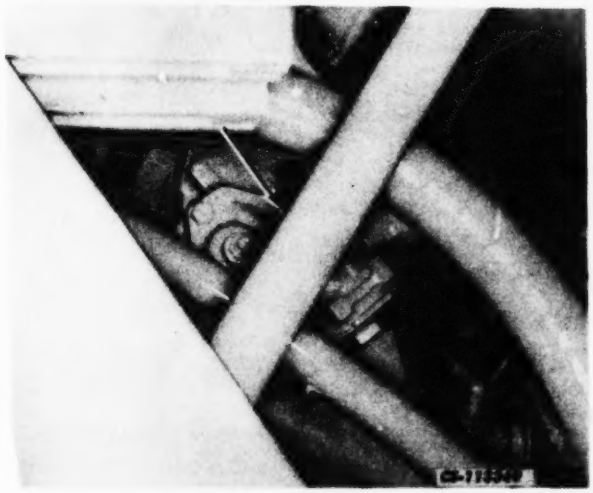


Fig. 18

**ITEM 20 — DRAG LINKS (Figs. 19 and 20)**

Apply lubricator to each fitting until clean grease appears.

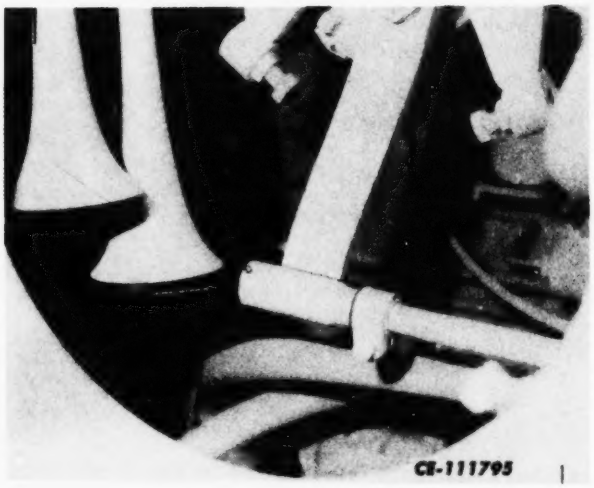


Fig. 19

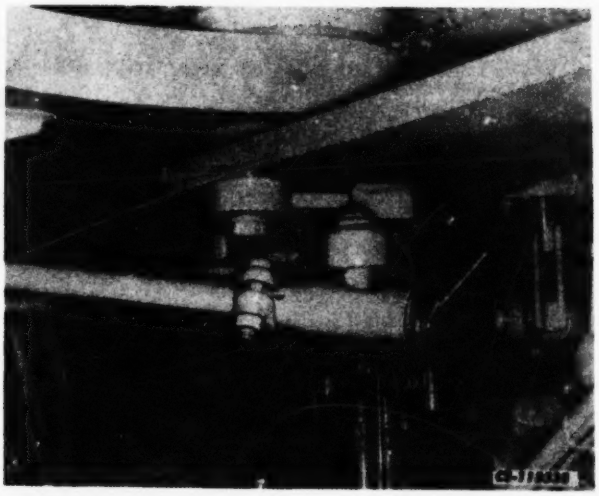


Fig. 20

**ITEM 21 — INTERMEDIATE DRIVE BLOCK (Fig. 21)**

**Checking Oil Level**

1. While the lubricant is at operating temperature park the machine on level ground, completely lower the bucket and apply the parking brake.

2. Remove oil level gauge (1) and wipe it clean.

3. Insert the gauge as far as it will go.

4. Remove the level gauge again and check the level. If the level is below the full mark add lubricant as necessary. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section for grade of lubricant specified.

5. Reinstall the gauge.

**Changing the Oil**

1. While the lubricant is at operating temperature park the machine on level ground, completely lower the bucket and apply the parking brake.

2. Remove the oil level gauge (1) and drain plug (2).

3. Install the drain plug after the oil has completely drained.

4. Fill the block through the level gauge hole. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in this section for grade and quantity of oil specified. Reinstall the gauge.

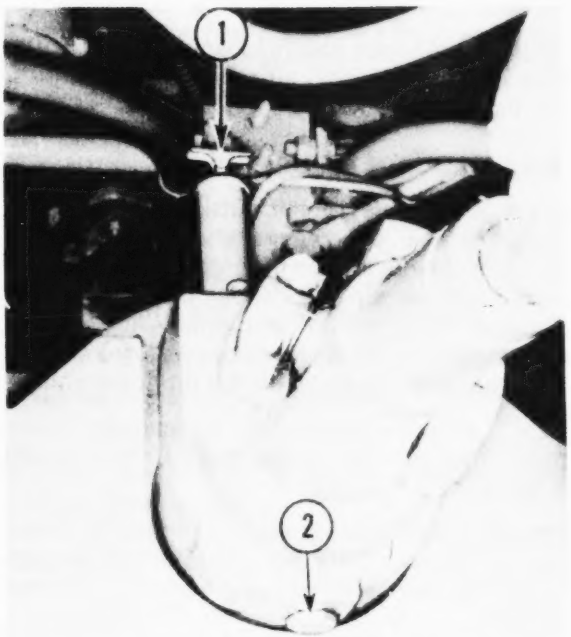



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**Fig. 21**

1. Level Gauge
2. Drain Plug

## SEASONAL PREPARATION

Proper maintenance and mechanical efficiency is assured during seasonal air temperature changes, when these instructions are followed.

### OUTSIDE SOURCE OF HEAT

Loaders which must be left outside for prolonged periods of time in sub-zero weather will suffer from the effects of what is known as "cold-soak". Actually, lubricants become so viscous that they are incapable of being moved to lubricate the moving parts; in the event the loader did move, extreme wear would result to the parts as the lubricant cannot flow.

Among these parts will be the engine, transmission and axles.

Some source of outside heat is necessary under these conditions. There is a good number of electric as well as propane-fired engine coolant heaters available.

Gas-fired forced air heaters may also be obtained to direct heat to the area of the transmission and axles.

### FUEL SYSTEM

Refer to "FUEL SYSTEM" in this section for the diesel fuels which give the most satisfactory performance for your International engine.

### LUBRICATION

Use the lubricants specified in the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in Section 7.

### COOLING SYSTEM

Prepare the cooling system as follows:

1. Check the entire system for leaks.

2. Inspect the condition of all hoses and replace the hoses and hose clamps where necessary.

3. Check the operation of the thermostats by observing the engine coolant temperature gauge on the instrument panel during operation. If the engine warms up slowly, the thermostats may be stuck in the open position. If the engine overheats, the thermostats may be inoperative by remaining closed.

4. Clean cooling system. For this procedure, refer to "COOLING SYSTEM" in this section.

5. Check the tension and condition of the alternator and fan belts and adjust or replace if necessary. For this procedure, refer to "BELTS" in this section.

6. Remove all bugs and dirt from the radiator core using air or water under pressure. Direct the flow through the core, opposite the normal direction of air flow.

7. Clean the radiator guard and outside of core.

8. Protect your cooling system from damage by using I.H. permanent (Ethyl-Glycol base) antifreeze. Refer to "FILLING THE SYSTEM" in this section.

### ELECTRICAL SYSTEM

Remove all corrosion from battery terminals and cables. Repair or replace all wires which have worn, cracked or frayed insulation; also broken or loose wires. Service the batteries. Refer to "ELECTRICAL SYSTEM" in this section.

## AIR CLEANING SYSTEM

This loader has a "dry-type" cleaner with replaceable elements (Fig. 1). The cleaner has two elements; primary and safety. The primary can be cleaned for a limited number of times before replacement is necessary, however, the safety element must be replaced when plugged. Detailed service procedures for this air cleaner are covered in the following text.

### PRECAUTIONS

As a precaution against dirt entering the engine:

All gasket and rubber hoses between the air cleaner, turbocharger and intake manifold, and between the manifold and cylinder head must be in good condition and the joints or connections must be tight.

Never remove the element from the air cleaner while the engine is running.

Never operate the engine unless the filter elements are in place and the filter cover gasket is installed.

### PRIMARY FILTER ELEMENT SERVICE

The air cleaner primary element must be serviced whenever indicated by the air cleaner service indicator. Refer to "AIR CLEANER SERVICE INDICATOR" in Section 3.

The primary element can be cleaned by either of two methods, washing or compressed air.

# MAINTENANCE

Washing is the preferred method as it removes more dust and soot and restores the element to an almost new condition. The result being bettery performance and longer intervals between required element service. It is suggested that a spare element is available for use while the serviced element is drying. This will reduce unit down-time to only a few minutes and will allow sufficient time to service the restricted element properly.

**NOTE:** *A filter element must be replaced after 6 washings.*

Cleaning the element with compressed air is not considered an entirely satisfactory method. Some dust will remain in the element causing more frequent servicing of the element. Use this method only as a temporary measure until sufficient time is available to clean the element by "washing."

**NOTE:** *After cleaning, if an element is to be stored for later use, place it in a plastic bag and store in an element shipping container to protect against dirt and damage.*

**Removal (Fig. 1)**

1. Stop the engine. Remove dust from the air cleaner body and cover.
2. Loosen wing nut (1) and remove cover (3).
3. Remove wing bolt (4), seal (5) and element (6).

   **NOTE:** *Be careful not to dislodge dust from the dirty element on to the safety element.*

4. Check the condition of seal (5). If the seal is damaged or missing, replace.

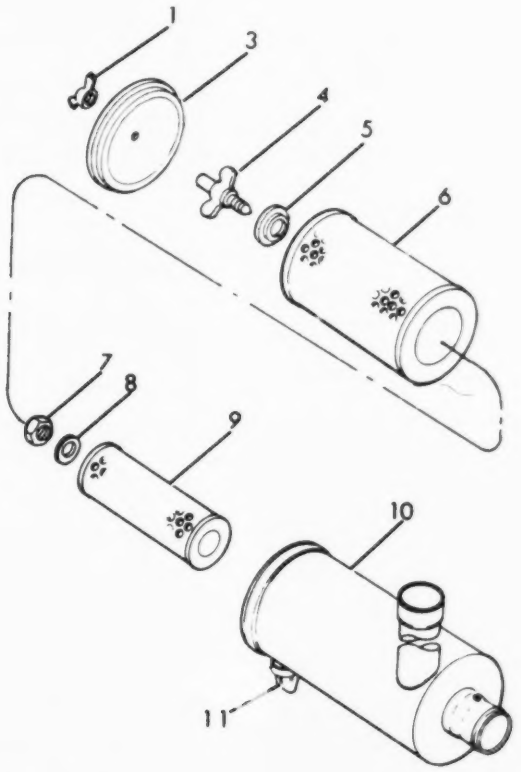


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**Fig. 1. Exploded View of Air Cleaner**

1. Wing Nut
2. Not Used
3. Cover
4. Wing Bolt
5. Seal
6. Primary Element
7. Nut
8. Seal
9. Safety Element
10. Body
11. Dust Vacuator Valve

5. Remove all dirt from the air cleaner body inside with a damp cloth. A small amount of non-sudsing detergent added to the water will remove the soot.

**Washing**

**NOTE:** *Never wash elements in fuel oil, gas or solvent. DO NOT OIL ELEMENTS. Do not attempt to take elements apart. Do not tap the element against a hard surface; this will damage the element.*

1. Tap the side or end of the element against the palm of your hand to remove loose dust.

2. Wash the element in clean, warm water +21° C to +38° C (+70° F to +100° F). A small amount of non-sudsing detergent added to the water will remove the soot.

3. Rinse the element in clear water (if a hose is used, do not exceed 275 kPa (40 psi). Shake the element carefully to remove excess water.

**NOTE:** *Do not use compressed air to speed the drying of the element; the air pressure will rupture the wet element.*

4. Lay the element on its side and allow it to air dry before reinstalling. Overnight drying is usually sufficient. When drying the element protect it from dirt and/or freezing.

**NOTE:** *If no spare element is available, the wet element, after excess water has been shaken out, may be installed in the air cleaner and the engine operated at low idle for 10 minutes before operating.*

5. Inspect for damage. Refer to "INSPECTION."

**Compressed Air**

An element cleaning tool (IH Part No. 407 073 R1, Fig. 2) for use with compressed air is available from your PayLine Distributor, and will do a faster and more efficient job of removing dust than a regular air gun or nozzle.

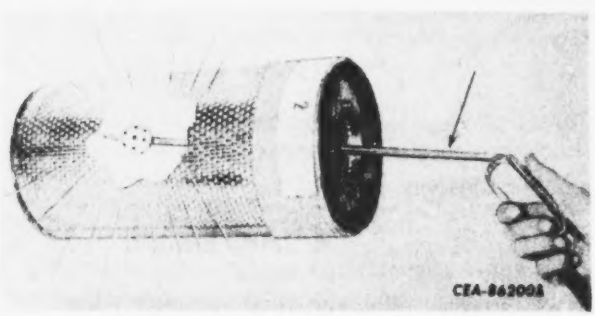


**Fig. 2. Using Element Cleaning Tool**

**NOTE:** *Do not tap the element against a hard surface; this will damage the element.*

1. Carefully tap side or end of the element against the palm of your hand to remove loose dust.

2. Direct clean, dry compressed air up and down the pleats on the clean side (inside) of the element.

**NOTE:** *Air pressure at the nozzle must not exceed 689 kPa (100 psi). Keep a reasonable distance between the air nozzle and the element.*

3. Inspect the element for damage. Refer to "Inspection" below:

**Inspection**

1. Inspect the filter element for leaks or damage by placing a bright light inside the element. Inspection of the element on the outside will disclose any holes where concentrated light shines through. The slightest rupture requires replacement of the filter element.

2. Inspect the contact surfaces of the element and the air cleaner body. If faulty or damaged gaskets or surfaces are noted, correct these conditions immediately.

**Installation (Fig. 1)**

1. Install the open end of the primary element into the air cleaner body over the safety element.

2. Install seal (5) and wing bolt (4).

3. Install cover (3) being sure it is not cocked. Tighten wing nut (1).

## SAFETY FILTER ELEMENT SERVICE

Replace the safety element with every third change of the outer element or when plugged as shown by the service indicator.

**Removal (Fig. 1)**

1. Refer to "Removal" under "PRIMARY FILTER ELEMENT SERVICE".

2. Remove nut (7), seal (8) and element (9).

**Installation (Fig. 1 or 2)**

1. Insert open end of element (9) into the air cleaner body. Install seal (8). Secure element with nut (7).

2. Refer to "Installation" under "PRIMARY FILTER ELEMENT SERVICE".

# MAINTENANCE

### AIR CLEANER SERVICE INDICATOR (Fig. 3)

The air cleaner service indicator signals when air filter element service is required. A complete description of the indicator can be found in Section 3.

After servicing the element, press the reset button (1) to reset the indicator.

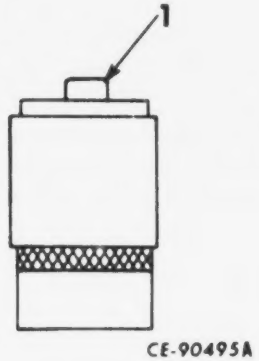


**Fig. 3**

### PRE-CLEANER HOOD

The pre-cleaner hood serves as a rain shield, and the screen prevents chaff and coarse dirt from getting into the air cleaner. Keep this screen clean from all chaff, oil or dust. Clogged holes in the screen will reduce the power of the engine by restricting the flow of air.

Loosen the clamp screw on the hood and remove it by twisting and pulling upward. Use compressed air to clean the screen. If compressed air is not available, wash in clean hot water or preferably water containing a small amount of non-sudsing detergent.

### DUST VACUATOR

Squeeze the dust vacuator, located at the bottom of the air cleaner housing, to remove accumulated dust. Be sure the valve lips are not stuck together.

### CRANKCASE BREATHER (Fig. 4)

The crankcase breather is located on the left hand side of the engine.

1. Remove the two screws securing the housing cover and remove the cover (1) and gasket.

2. Remove the breather retainer along with the element from the housing (2).

3. Wash the retainer and element in kerosene or diesel fuel. Dry thoroughly.

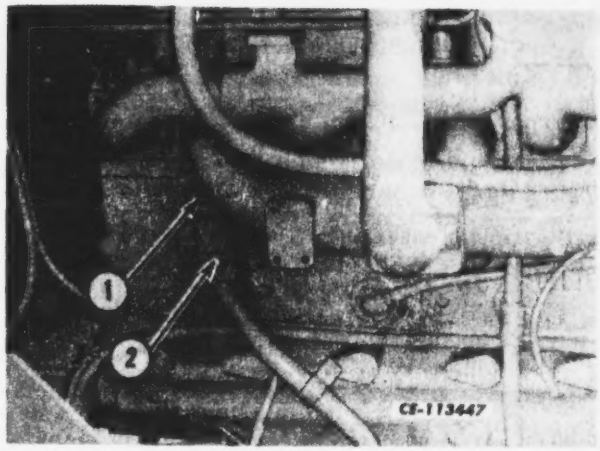


**Fig. 4. Crankcase Breather**

1. Cover 2. Housing

**NOTE:** *If the breather element remains plugged after cleaning or if the element is badly corroded, replace the element.*

4. Install the element and retainer in the housing.

5. Install the housing cover with gasket and secure with hardware removed in step 1.

### CAB HEATER AIR FILTER (If Equipped) (Fig. 5)

The heater air filter cleans the air flowing through the heater. When working in extremely dusty conditions the filter should be cleaned more often than the interval shown in Section 7.

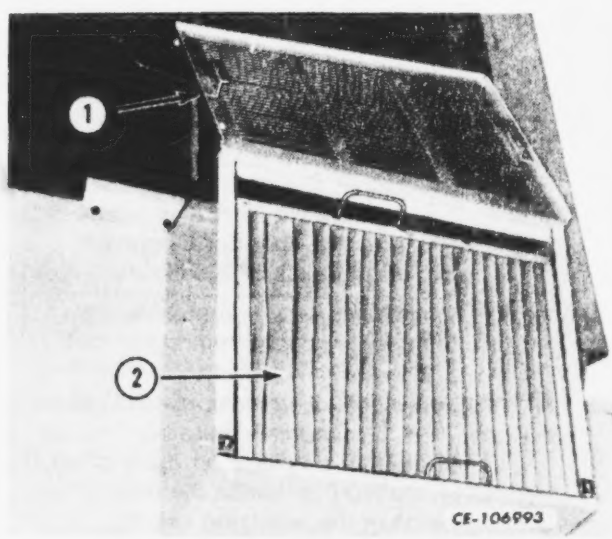


**Fig. 5. Cab Heater Air Filter**

1. Loosen the thumb screws securing the grille (1) and lift the grille.

2. Remove the filter (2).

3. Remove the loose dirt from the filter by tapping it against the palm of your hand.

4. Blow compressed air, not exceeding 690 kPa (100 psi), through the filter to remove imbedded dust.

5. If the filter fails to come clean soak it in luke warm water containing a mild soap and rinse clean.

**NOTE:** *Do not dry a wet filter with compressed air.*

6. Install the filter so the small mesh screen is to the outside. Close the grille and secure it with the thumb screws.

## BELTS

Prior to installing the new belts, make sure all pulley grooves are clean and not worn. If a pulley is damaged or the grooves are worn, it should be replaced.

All pulley supporting bearings, shafts, and brackets, must be in working order.

When replacing belts and pulleys, pulley alignment must be checked with belts tensioned and brackets securely clamped. A misalignment that can be detected by the naked eye is detrimental to belt performance.

Belts on new machines and replacement belts lose their tension as they seat into the pulley grooves.

Check and adjust tension of new belts at 20 hour intervals until tension is stabilized and thereafter, every 200 hours. If the tension falls below a required minimum, the belt slips, damaging the belt and pulley grooves.

**NOTE:** *When operating in abrasive type conditions, check the belts every 100 hours.*

**CAUTION! When checking, adjusting or replacing belts be sure the electrical master switch is in the off position.**

### BELT TENSION

The tension applied to a new belt (initial installation only) is different than the retension applied to a used belt (one that has been run five minutes or longer).

Belt tensions are to be measured by means of a "Gates KRIKIT Gauge" to insure correct tensions. This gauge may be obtained from:

Gates Rubber Company
999 South Broadway
Denver, Colorado 80217

The correct belt tensions measured with a "Gates KRIKIT Gauge" are shown in the following chart.

| BELT TENSION CHART (Using "KRIKIT" Gauge) | | |
|---|---|---|
| | Alternator Belt | Air Compressor Belt |
| Condition | Point A | Point B |
| New Belt Installation | 70 to 75 lbs. | 95 to 100 lbs. |
| New Machine Upon Delivery<br>1 Hour After Belt Replacement<br>After 10 Hours of Operation<br>After 50 Hours of Operation<br>At Intervals of 200 Hours | 60 to 65 lbs. | 80 to 85 lbs. |
| Minimum Permissible Tension | 45 lbs. | 60 lbs. |

**NOTE:** *Do not allow belt tensions to fall below the specified "Minimum Permissible Tension" values. Check the belt tension more often if necessary. Do NOT retension the belts to tension higher than the retension values.*

*In emergency cases only when a Gates belt tension gauge is not available and the machine must be operated,* belt tensions may be checked by "Deflection Method".

The use of "Fishook Scale and Straight Edge" (Fig. 6) is preferred over the unreliable "Thumb Method". The required belt deflections under 111 N (25 lbf) deflecting force are shown in the following chart.

# MAINTENANCE

| BELT TENSION CHART (Deflection Method) | | |
|---|---|---|
| Condition | Alternator Belt<br>Point A | Air Compressor Belt<br>Point B |
| New Belt Installation | 22mm (7/8 in.) | 19mm (3/4 in.) |
| New Machine Upon Delivery<br>1 Hour After Belt Replacement<br>After 10 Hours of Operation<br>After 50 Hours of Operation<br>At Intervals of 200 Hours | 23mm (29/32 in.) | 21mm (13/16 in.) |
| Minimum Permissible Tension | 25mm (1 in.) | 22mm (7/8 in.) |

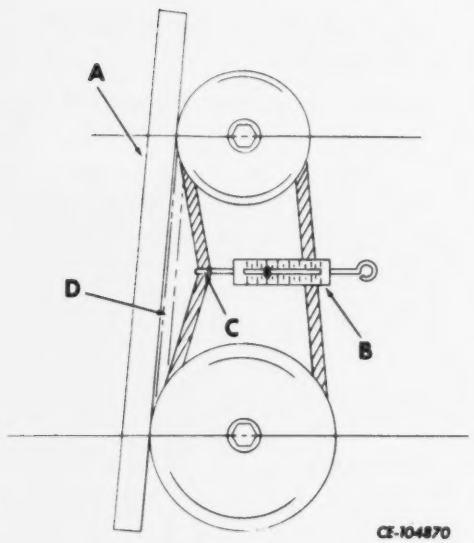


**Fig. 6. "Deflection Method"**

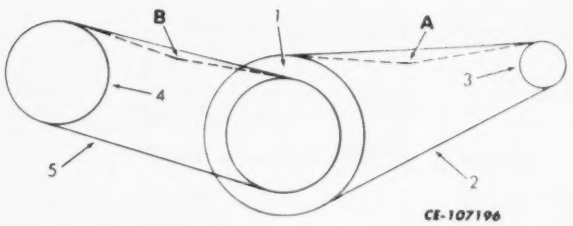


**Fig. 7. Belt Tension Check Points**

1. Fan Pulley
2. Alternator Belt
3. Alternator Pulley
4. Air Compressor Pulley
5. Air Compressor Belt

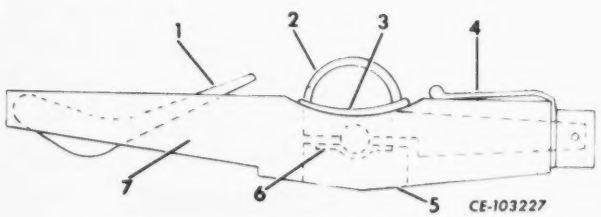


**Fig. 8. Gates KRIKIT Gauge**

1. Indicator Arm
2. Rubber Finger Loop
3. Pressure Pad
4. Pocket Clip
5. Positioning Flange
6. Tension Spring
7. Body

**Tension Check Points (Fig. 7)**

Check belt tensions at points (A, B and C) shown in Fig. 7. The check must be made midway between the pulleys.

**Using "Gates KRIKIT Gauge" (Fig. 8)**

1. There are several ways to hold the gauge while testing belt tension.

a. By holding the rubber loop (2) with the ends of the thumb and index fingers directly on the raised pressure pad (3) (Fig. 9).

b. By inserting the index finger through top of the rubber loop (2) (Fig. 9).

c. By slipping the index finger between the rubber loop (2) and pressure pad (3) (Fig. 9).

**NOTE:** *DO NOT touch the gauge with any other finger while testing the belt, as this will cause the gauge to read inaccurately.*

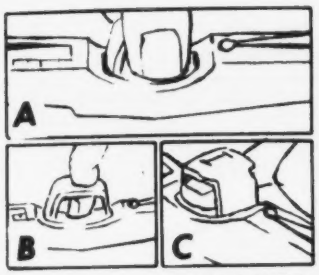


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**Fig. 9. Holding the Gauge**

2. Position the gauge in the center of the belt between the two pulleys. The flange (5) should be flat against the top edge of the belt (Fig. 11). Make sure the indicator arm (1) is below the scale on top of the body (7).

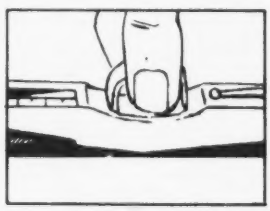

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**Fig. 11. Positioning the Gauge**

3. Very slowly press on the pressure pad (3) at a right angle to the belt surface until you hear or feel the click release of the tension spring (6). DO NOT PRESS ANY MORE as soon as the spring clicks and the indicator arm (1) shows the correct reading (Fig. 12).

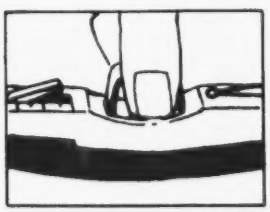

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**Fig. 12. Pressing for Reading**

4. The correct tension reading is read at the point where the top of the indicator arm crosses the numbered scale on the top of the gauge body, as shown in Fig. 13.

**NOTE:** *Before adjusting belt tension, check the tension several times. Use an average of the readings.*

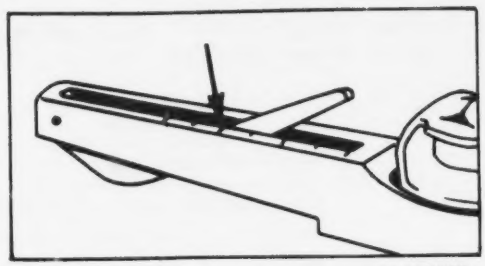

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**Fig. 13. Reading Belt Tension Gauge**

## ADJUSTMENT

### Alternator Belt (Fig. 14)

1. Loosen the fan guard mounting bolts (A) and remove the fan guard.

2. Loosen the brace bolt (B) and the mounting bolt (C).

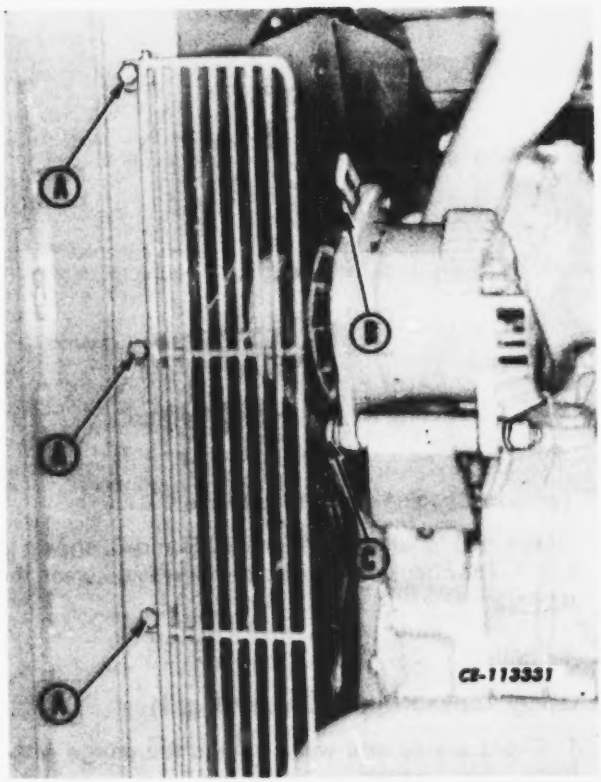



**Fig. 14. Alternator Belt Adjustment**

A. Fan Guard Mounting Bolt
B. Adjusting Brace Bolt
C. Mounting Bolt

3. Move the alternator out to tighten the belt, or in to loosen the belt to get the correct tension. Refer to "TENSION" in this section.

**NOTE:** *Excess belt tension will damage the alternator bearings. If a pry bar is used, DO NOT OVER TENSION.*

4. Tighten brace bolt (B) and mounting bolt (C).

5. Install the fan guard.

**Air Compressor Belt (Fig. 15)**

1. Loosen the fan guard mounting bolts (A) and remove the fan guard.

2. Loosen the four compressor mounting nuts (B).

3. Move the compressor out to tighten the belt or in to loosen it.

4. When the correct belt tension is obtained, tighten nuts (B).

5. Install the fan guard.

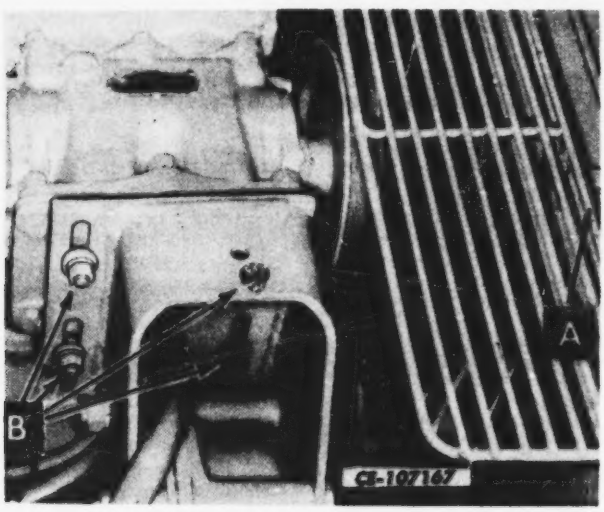



**Fig. 15. Air Compressor Belt Adjustment**

A. Mounting Nuts B. Adjusting Nut

**REMOVAL AND REPLACEMENT**

Replace badly worn, severely cracked or oil (or grease) soaked belts immediately.

Do not use belt dressing on belts.

When replacing a belt, always check the condition of the remaining belt on the engine, and if necessary, replace them at the same time.

Prior to installing the new belt, inspect all pulley grooves for wear and the presence of grease, oil, dirt, etc. If foreign material is present, it should be removed. If a pulley is damaged or grooves worn, it should be replaced. When replacing belts and pulleys, pulley alignment must be checked under belt tensioned conditions (brackets securely clamped). A misalignment that can be detected by the naked eye is detrimental.

All pulley supporting bearings, shafts and brackets, etc. must be in working order.

During assembly, do not force the belt into the pulley grooves by prying with a screwdriver, pry bar, etc. This will damage the belt side cords which will cause the belt to turn over in the pulley grooves and will end in complete destruction of the belt in operation.

If a belt is disturbed for any reason, the belt must be adjusted to the correct belt tension.

**Alternator Belt (Fig. 14)**

1. Loosen bolts (A) and remove the fan guard.

2. Remove the fan from the fan pulley. Lay the fan against the radiator core. Be careful not to damage the radiator core.

3. Loosen the brace bolt (B) and mounting bolt (C).

4. Move the alternator in toward the engine.

5. Slip the old belt over the pulleys and remove it.

6. Install the new belt on the fan pulley and over the top of the alternator pulley.

7. Push in on the alternator, if necessary, and slide the belt over the alternator pulley.

8. Adjust the belt tension. Refer to "Alternator Belt" under "ADJUSTMENT" in this section.

9. Install the fan on the fan pulley. Install the fan guard.

**Air Compressor Belt**

1. Loosen bolts (A) and remove the fan guard.

2. Remove the fan from the fan pulley. Lay the fan against the radiator core. Be careful not to damage the radiator core.

3. Loosen the alternator brace bolt (B, Fig. 14) and mounting bolt (C).

4. Move the alternator in toward the engine.

5. Remove the belt from the alternator pulley and the fan pulley.

6. Loosen the four air compressor mounting nuts (A, Fig. 15).

7. Move the air compressor in toward the engine.

8. Remove the belt from the compressor pulley and the fan pulley.

9. Install the new belt in the fan pulley and over the air compressor pulley.

10. Adjust the belt tension. Refer to "Air Compressor Belt" under "ADJUSTMENT" in this section.

11. Install the alternator belt in the fan pulley and over the alternator pulley.

12. Adjust the alternator belt tension. Refer to "Alternator Belt" under "ADJUSTMENT" in this section.

13. Install the fan on the fan pulley. Install the fan guard.

## AIR PRESSURE SYSTEM

### DRAINING WATER FROM THE AIR TANKS (Fig. 16)

**CAUTION! Completely lower the bucket to prevent vehicle movement. Be sure there is an adequate supply of pressure in the air system.**

**CAUTION! Do not open the drain valves more than two turns.**

Start the engine and build up air pressure in the air system then shut down the engine. Open the air tank drain valves (Fig. 16). Drain accumulated water from the tanks then close the valves.

**NOTE:** *It is especially important that the air tanks are thoroughly drained of water in cold weather.*

### AIR LINES

Inspect all hoses to be sure they are not deteriorating.

1. Coat all air system hose connections with soapsuds to check for leakage.

2. Apply the brakes while checking those hose assemblies that lead from the brake valve to the service brake power clusters.

3. Continue applying the brakes until the check has been completed.

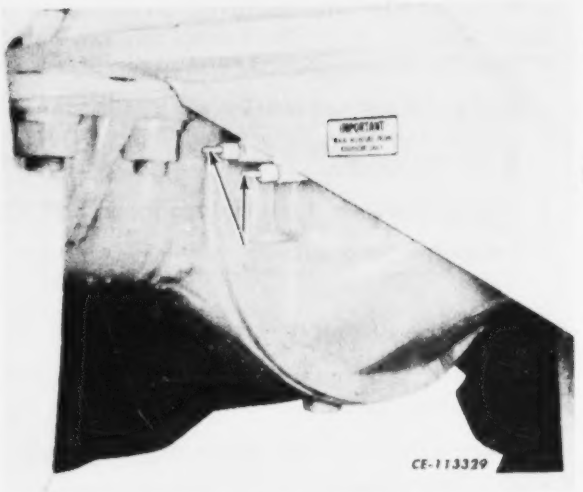



**Fig. 16. Air Tank Drain Valves**

### ALCOHOL EVAPORATOR (If Equipped) (Fig. 17)

**CAUTION! Do not smoke or use an open flame near the area of the alcohol evaporator while it is being serviced. Stop the engine before removing the filler cap; loosen the cap slowly to relieve built-up air pressure in the evaporator.**

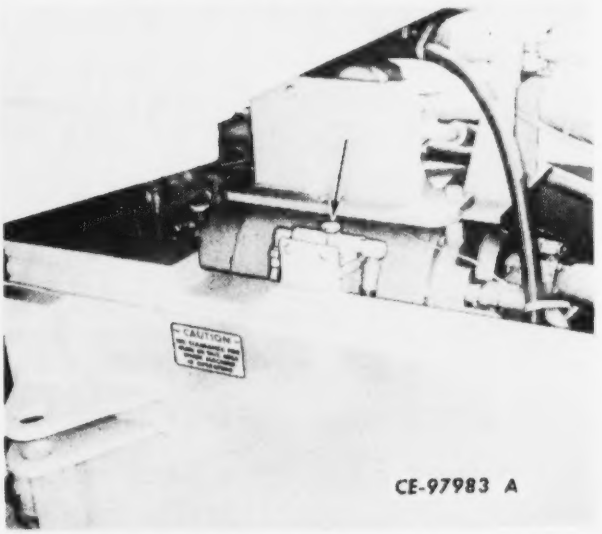



**Fig. 17. Alcohol Evaporator**

The function of the alcohol evaporator is to inject alcohol vapor into the air system to prevent condensation from accumulating and freezing in the brake system. Warm air from the compressor passes through the injector and evaporates small amounts of alcohol. This air-alcohol mixture is then piped into the air system. Keep the evaporator tank filled.

Stop the engine, remove the filler cap from the top of the tank and fill with methyl alcohol. Install the cap.

If the evaporator should ever become empty during machine operation open the drain, located at the bottom of the evaporator, and drain off accumulated moisture before filling. Close valve after draining.

## BRAKES

### SERVICE BRAKES

This machine is equipped with expanding shoe air over hydraulic brakes.

The brake system is divided into two separate circuits, each having its own air and hydraulic supply. One circuit operates the front brakes and the second operates the rear brakes. In the event of a failure in one circuit, the braking system still retains braking effort in the remaining circuit.

When the brake pedal is applied, air pressure in the service brake power cluster air chamber forces a piston in the service brake power cluster hydraulic (master) cylinder to pressurize brake fluid to the wheel cylinders. This pressurized fluid forces plungers to expand the brake shoes against the brake drum.

**CAUTION! Trapped air in the hydraulic brake lines between the service brake power cluster and the wheel cylinders reduces braking effectiveness. Bleed the brakes.**

#### Checking Power Cluster Fluid Level and Servicing Breather

**NOTE:** *The procedure is the same for all power clusters.*

1. Clean the area around the filler plug (1, Fig. 18) and remove the plug.

2. Check the fluid level. The correct level is 9-13mm (3/8-1/2 in.) from the top of the housing. If necessary add fluid. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in Section 7 for grade of fluid specified.

3. Install and tighten filler plug.

4. Remove breather from the power cluster.

5. Wash the breather in a commercial solvent.

6. Dry the breather using compressed air or shake to remove as much solvent as possible.

7. Dip the caps in clean engine oil and allow excess oil to drain out.

8. Install the breather in the power cluster.

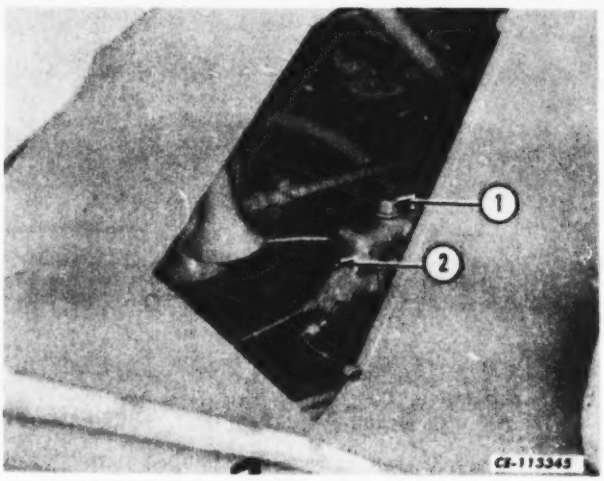



**Fig. 18. Power Cluster**

1. Filler Plug 2. Bleeder Screw

#### Checking Brake Wear

1. Start the engine and build up air pressure. Shut down the engine.

2. With the service brakes fully applied measure the stroke indicator on each power cluster. The length of the indicator should be less than 57mm (2-1/4 in.). If the length of the indicator exceeds this dimension, the brakes require adjustment. Refer to "Adjusting the Brakes" in this section.

#### Adjusting the Brakes

**CAUTION! Install blocking in front of and behind the wheels before adjusting the brakes.**

1. With an adjusting spoon or screwdriver turn the star wheels (1 and 2, Fig. 19), one at a time, until the brake shoe linings move out against the drum.

2. Back off each star wheel seven notches or clicks of the detent. This will allow proper running clearance.

3. Repeat the above adjustment procedure to each wheel.

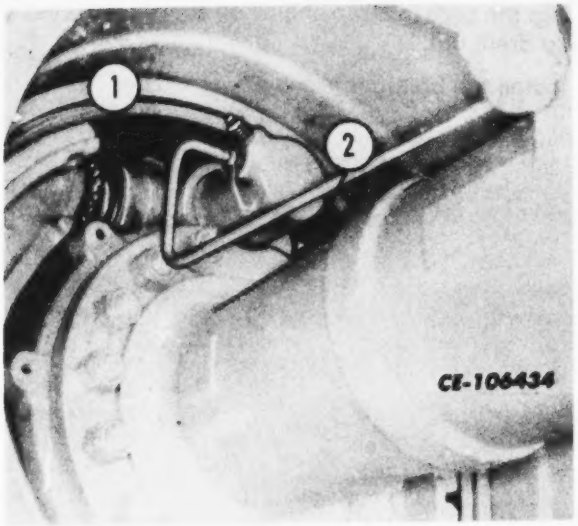



**Fig. 19. Brake Adjusting Star Wheels**

### Bleeding the Brakes

**CAUTION! Install blocking in front of and behind the wheels before bleeding the brakes.**

**NOTE:** *Bleeding the brakes is a two man operation.*

Each axle has one pair of brakes and power clusters. The following describes the method for bleeding one pair of brakes and power clusters.

1. Check power cluster fluid level as described in this section.

2. Be sure there is adequate air pressure in the system.

**CAUTION! Be careful not to splash brake fluid into your eyes.**

3. Open the bleeder valve (2, Fig. 17) on the power cluster. Depress and hold the brake pedal until clean, air free fluid appears, then close the bleeder valve and release the brake pedal.

4. Attach a bleeder hose to the wheel cylinder bleeder valve (Fig. 20). Direct the end of the hose away from the brake drum.

5. Open the bleeder valve. Depress and hold the brake pedal until clean air free fluid appears. Close the bleeder valve and release the brake pedal.

6. Depress and release the brake pedal several times.

7. Depress the brake pedal and open the same bleeder valve (Fig. 20). After the fluid flow stops, close the valve and release the pedal.

8. Remove the bleeder hose.

9. Repeat steps 4 through 8 for the brakes on the opposite end of the axle and power cluster. It may be necessary to replenish the air system.

10. Check power cluster fluid as described in this section.

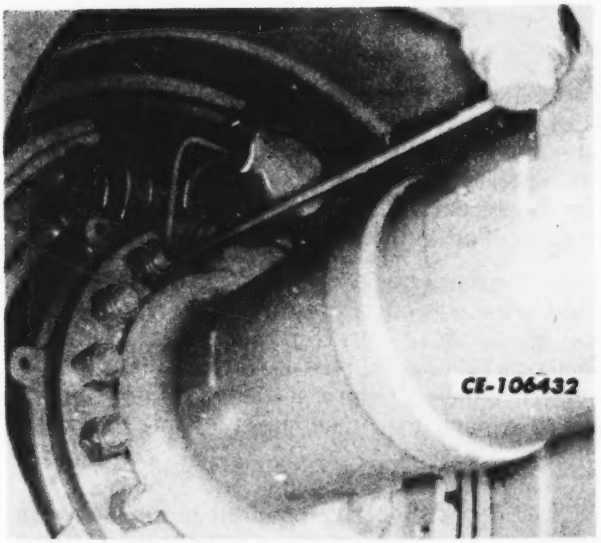



**Fig. 20. Wheel Cylinder Bleeder Valve**

### PARKING BRAKE (Fig. 21)

This machine is equipped with a mechanically operated, expanding shoe, type parking brake. The parking brake is mounted in the front drive line between the drive shaft and the intermediate drive block.

### Adjustment

**CAUTION! Install blocking in front of and behind the tires before adjusting the parking brake.**

A minor brake adjustment can be made by turning the adjustment knob on the parking brake control lever several turns clockwise. After this method of adjustment has reached its limit proceed as follows:

a. Install blocking in front of and behind the wheels. Release the parking brake.

b. Back off the parking brake control lever adjusting knob.

c. Remove the cotter pin and clevis pin (1) that is securing the clevis (3) to the brake lever (5).

d. Loosen jam nut (2) and back it away from the clevis a few turns.

e. Shorten the length of the brake cable (4) by rotating the clevis onto the cable clockwise. The cable should be shortened enough to remove all slack out of the brake arm (5) without causing contact between the brake lining and drum.

f. Reinstall the clevis pin (1) through the clevis and brake arm. Secure the clevis pin with the cotter pin.

g. Tighten jam nut (2) down against the clevis (3).

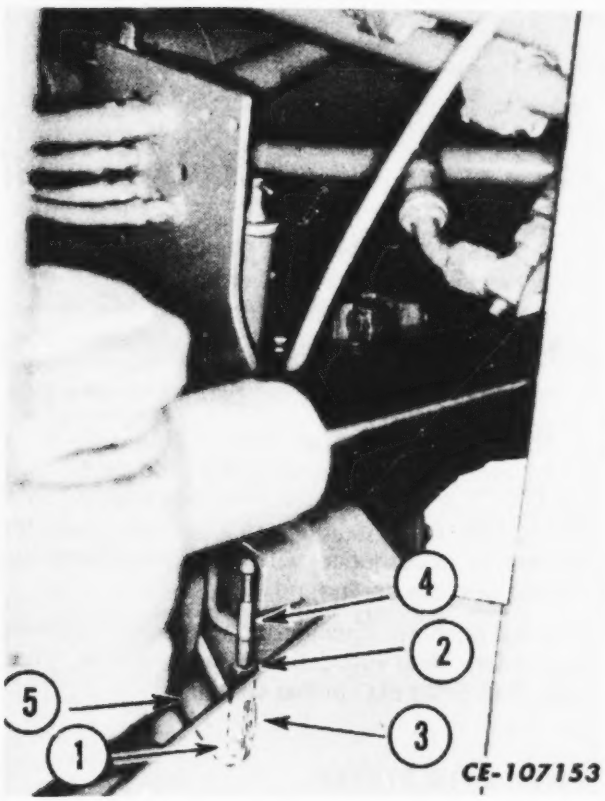



**Fig. 21. Parking Brake Linkage**

1. Clevis Pin
2. Jam Nut
3. Clevis
4. Cable
5. Brake Arm

h. Remove wheel blockings, start the engine and apply the parking brake.

**CAUTION! Be sure the area in front of the machine is clear of personnel and obstructions as the vehicle may move forward during this test.**

i. Place the transmission directional lever in the forward position and the transmission gear range lever in the 4th gear range position. Fully accelerate the engine. If the loader moves forward, the parking brake must be readjusted or the linings replaced. Refer to your PayLine Distributor for brake lining replacement.

## COOLING SYSTEM

The cooling system operates under pressure which is controlled by the pressure relief valve in the radiator cap.

The water pump circulates the coolant through the engine block, cylinder heads, radiator, and engine oil cooler. Circulation is controlled by the thermostats which by-pass coolant flow from the radiator until the engine reaches operating temperatures.

### CARE OF THE SYSTEM

Proper cooling is assured only when the system is sealed; the radiator cap gasket is in good condition; and thermostats are operating properly; the system is free of coolant and air flow restrictions; and the system is filled to the proper level.

To keep the system internally free of rust and sludge, add "IH Cooling System Conditioner" to the water during warm weather operation or use IH Antifreeze and Coolant during cold weather operation. Use softened or rain water when possible; these provide the greatest protection against scale accumulations.

Drain and thoroughly flush the system at least once a year. The appearance of rust or sludge in the system indicates the rust and sludge inhibitor additives are weakened and must be replaced. Refer to "CLEANING THE SYSTEM" in this section.

### DRAINING THE SYSTEM

1. Run the engine until it reaches normal operating temperature, then stop the engine. Lower the bucket completely and apply the parking brake.

**CAUTION! Loosen the radiator cap slowly to gradually release any pressure build-up.**

2. Remove the radiator cap.

3. Open the radiator drain valve located behind the cover plate (Fig. 22).

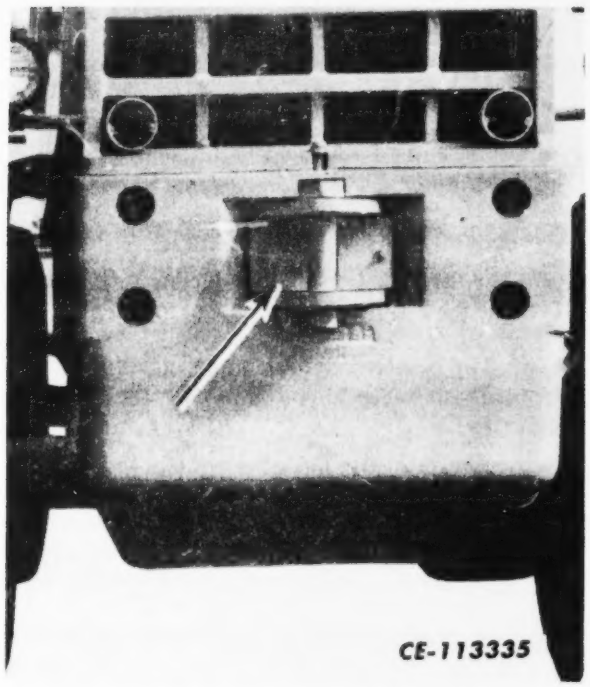



Fig. 22. Radiator Drain Valve Cover Plate

4. Drain the engine as follows:

a. Open the oil cooler drain valve (Fig. 23).

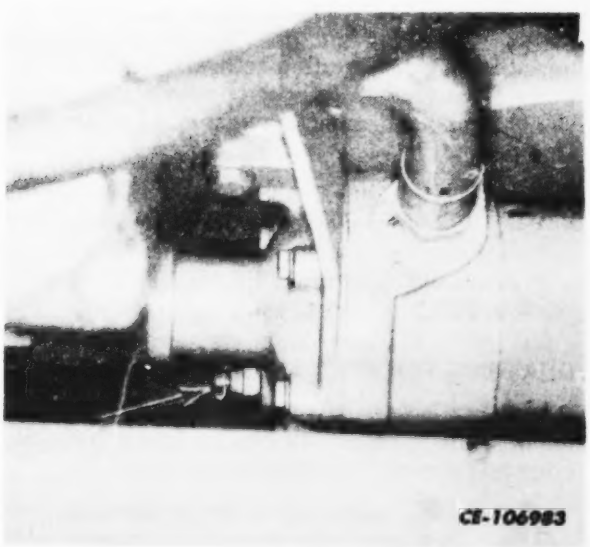



Fig. 23. Engine Oil Cooler Drain Valve

b. Open the engine crankcase drain valve (Fig. 24).

5. If equipped, open the two heater shut-off valves located on the engine.

6. Allow the system to drain completely; do not allow drain outlets to plug up during draining.

7. After system has drained, close the drain valves.

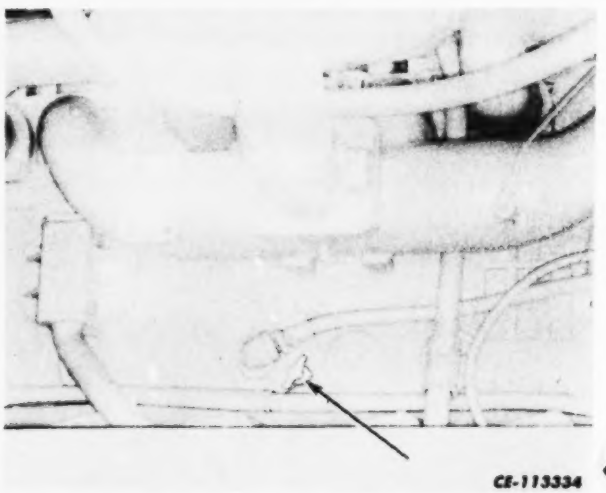



Fig. 24. Crankcase Drain Valve

## CLEANING THE SYSTEM

1. Drain the system. Refer to "DRAINING THE SYSTEM" in this section.

2. Fill the system with clean water. Add "IH Cooling System Cleaner and Conditioner" or a flushing compound that is compatible with aluminum. Flush the system in accordance with the instructions furnished with the compound.

3. After flushing, rinsing, and completely draining the system, refill with clean solvent. Refer to "FILLING THE SYSTEM" in this section.

## FILLING THE SYSTEM

Do not add cold coolant into the radiator of an overheated engine unless absolutely necessary. However, if necessary:

— Remove the radiator cap carefully.

— Coolant must be added to radiator slowly with engine running at low idle speed.

1. Fill the cooling system slowly. This allows more air to escape and the system to be filled to maximum capacity. Install "IH Cooling System Conditioner" (for warm weather operation) or IH Antifreeze and Coolant (for cold weather — consistently at or below 0° C/32° F) according to the instructions printed on the container. Refer to "ANTIFREEZE" in this section.

**NOTE:** *Use only a corrosion inhibitor that is compatible with aluminum. DO NOT use inhibitors labeled as "acid neutralizers".*

2. Start engine and run until normal operating temperature is reached; adding coolant when needed to keep proper level of 25mm (1 in.) above the baffle.

3. After all air is removed and level remains fixed, install the radiator cap. Check all drains for leakage.

### ANTIFREEZE

IH Antifreeze and Coolant (permanent type) is the recommended solution for this loader. DO NOT use methanol or alcohol as an antifreeze.

**NOTE:** *Do not mix types of antifreeze solutions. Mixed solutions make it impossible to determine the protection against freezing.*

Check the solution frequently and at normal operating temperature, to be sure the cooling system has sufficient protection against freezing.

The following table shows the approximate percentage of antifreeze solution required for the various temperatures.

| Approximate Freezing Point | | USE IN COOLING SYSTEM |
|---|---|---|
| | | IH Antifreeze and Coolant |
| °F | °C | (Ethylene Glycol-Permanent Type) |
| +20° | - 7° | 16% |
| +10° | -12° | 25% |
| 0° | -18° | 33-1/3% |
| -10° | -23° | 40% |
| -20° | -29° | 45% |
| -30° | -34° | 50% |
| -40° | -40° | 54% |
| -50° | -46° | 58% |
| -60° | -51° | 62% |
| -70° | -57° | 65% |

### CLEANING THE RADIATOR

Minor internal sludge accumulations will be removed when flushing the cooling system.

When internal accumulations are found that cannot be removed by normal flushing methods, consult your PayLine Distributor.

Remove all bugs and dirt from the radiator core using air or water under pressure. Direct the flow through the core, opposite the normal direction of air flow.

### RADIATOR CAP

The radiator cap regulates coolant pressure and seals the radiator filler opening. Positive sealing and correct coolant pressure requires the cap gasket and contacting surfaces in good condition.

Replace the cap if the gasket is worn or cracked.

### THERMOSTATS

The thermostats have two functions, gain rapid engine warm-up and control coolant temperatures. The thermostats are nonadjustable type. Engine overheating is sometimes due to a faulty thermostat. Remove and check the thermostats as follows:

#### Removal

1. Open the crankcase water drain valve (Fig. 24) and drain coolant to a level below the thermostat housing. Close the valve.

2. Disconnect the radiator inlet hose and thermostat bypass hose at the thermostat housing.

3. Remove the five capscrews securing the thermostat housing (1, Fig. 25) to the front water manifold (5). Remove housing seals (2) and gasket (4).

4. Remove thermostats (3) from the manifold.

5. Clean housing, removing all scale and rust.

**Fig. 25. Thermostats and Related Parts**

1. Housing
2. Seal
3. Thermostat
4. Gasket
5. Manifold

**Checking (Fig. 26)**

1. Clean the thermostats. Replace the thermostats if coated with scale as this will not allow proper operation.

2. Check the thermostats as follows:

   a. Suspend the thermostat and a thermometer in a container of water.

   **NOTE:** *Do not allow either one to contact the container sides or bottom.*

   b. Heat water and carefully note temperature when thermostat starts to open (approx. 75°C/+167°F) and when fully open (approx. 89°C/+192°F).

   c. If the thermostat does not function as described replace it.

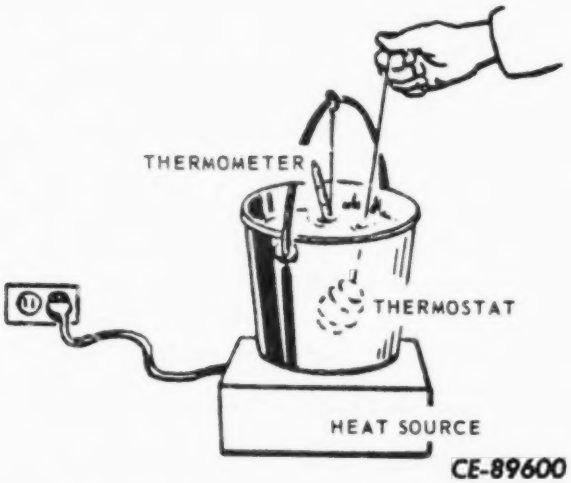



**Fig. 26. Checking the Thermostats**

**Installation**

1. Clean the gasket surfaces of housing (1, Fig. 25) and manifold (5) to assure proper sealing when reassembled.

2. Install seals (2) and thermostats (3) in the housing.

3. Using a new gasket (4) secure housing to manifold (5). Refer to "SPECIAL TORQUES" in Section 9.

4. Reconnect the radiator inlet hose and thermostat housing bypass hose. Refer to "TORQUE VALUES FOR HOSE CLAMPS" in Section 9.

5. Fill the cooling system. Refer to "FILLING THE SYSTEM" in this section.

**WATER PUMP**

No lubrication of the pump is required as the bearings are of the permanently sealed type and are packed with special lubricant at the factory for the life of the bearing.

When water pump bearings show excessive looseness or if water leak develops, consult your PayLine Distributor.

## ELECTRICAL SYSTEM

**PRECAUTIONS**

Before working on any part of the electrical system place the electrical system master switch in the "OFF" position.

All terminals must be clean and fastened securely. Never paint electrical connections or the alternator. Repair or replace all broken wires immediately.

Surface under all terminals must be clean and good electrical connections must be established after reassembly. Also all clips must grip cables tightly to prevent vibrations and rapid cable wear. All clips and straps must be closed in a workmanlike manner, so as not to damage the insulation.

**CAUTION! When installing batteries be sure to connect the ground cable to the negative terminal. When connecting a booster battery or battery charger, make certain to connect the negative terminal to the negative terminal and the positive terminal to the positive terminal. Do not short across or ground any terminals of the alternator. Do not connect any cable to the "R" terminal on the alternator. Failure to observe these precautions will result in severe damage to the harness and alternator.**

**ALTERNATOR WITH INTEGRAL REGULATOR**

The electrical generating system incorporates a direct diode rectified generator (alternator) which requires special handling and procedures different from those associated with the old style DC generator.

The alternator requires no lubrication since its bearings are factory lubricated for life and require attention only at time of major overhaul.

# MAINTENANCE

The alternator is equipped with an integral, tranistorized voltage regulator. This regulator incorporates a voltage adjustment which can be set to maintain satisfactory battery charge.

**NOTE:** *The unit electrical system is negative ground. Be CERTAIN the ground polarity is correct when:*

*a. Installing a new battery.*
*b. Connecting a battery charger.*
*c. Using a booster.*

*Failure to observe proper polarity will result in damage to the alternator*

NEVER use a fast charger as a booster to start the engine.

NEVER unhook a battery terminal while the engine is running.

NEVER disconnect the alternator cable while the engine is running.

DO NOT POLARIZE THE ALTERNATOR.

DO NOT SHORT ACROSS OR GROUND ANY TERMINALS OF THE ALTERNATOR.

**Voltage Adjustment (Fig. 27)**

If the battery uses too much water at normal setting (position "2" on the cap aligned with the arrows) reduce the voltage setting by aligning "Lo" on the cap with the arrow.

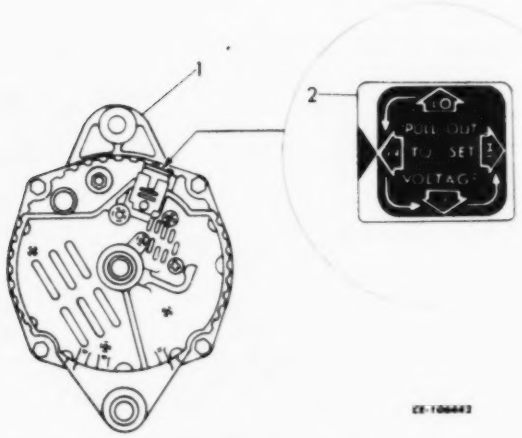



**Fig. 27. Regulator Adjustment Cap**

If the battery is consistently undercharged at the normal setting (position "2" on the cap aligned with the arrow), increase the voltage setting by aligning the "3" position on the cap with the arrow. If further increase is desired, align "Hi" position on cap with arrow.

**NOTE:** *If either of the conditions persists after making the adjustments, consult your PayLine Distributor.*

## CRANKING MOTOR

The cranking motor must be lubricated every 5000 hours under normal starting conditions, or sooner, should it become necessary to remove the motor in the process of engine servicing.

**NOTE:** *Tag all disconnected cables for ease of correct installation.*

1. Disconnect all electrical cables and remove cranking motor.

2. Clean outer surfaces.

3. Saturate all wicks and lightly lubricate the splines underneath the clutch housing with Grade-10 engine oil.

4. Install the cranking motor and connect all electrical cables. Refer to "SPECIAL TORQUES" in Section 9.

If the cranking motor fails to operate properly, consult your PayLine Distributor.

## STOP LIGHT SWITCH

To check the stop light switch for proper operation, the air pressure gauge must be in the "RUN" area. Station a helper at the rear of the machine to observe the stop lights. Depress one of the brake treadles. The stop lights should go on. If not, check for and correct the problem. Possible trouble areas may be the fuse, burned out bulbs, or the stop light switch.

## CIRCUIT BREAKERS

The lighting and starting circuits are protected by an automatic reset circuit breaker. A 15 and 25 amp unit is mounted on the underside of the instrument panel. In the event of a "short circuit" or "ground", the circuit breaker will open before damage occurs and will continue to open and close until the trouble clears or is corrected. The circuit breaker will then return and stay in its normal closed position. It is important to use the same capacity circuit breaker for replacement. To install a new circuit breaker, reach under the instrument panel and remove the two screws securing the circuit breaker and replace with a new circuit breaker.

### LAMP REPLACEMENT

#### Instrument Panel Lights

Reach behind the instrument panel and pull the light socket free of the gauge. Depress the bulb, turn it counterclockwise in the socket and pull the bulb free of the socket. Insert the new bulb, depress and turn clockwise until bulb stops. Replace socket as removed.

#### Front and Rear Working Lights

Raise the rubber retainer lip; remove the sealed beam unit. Disconnect the plug from the sealed beam and install a new one.

#### Tail and Stop Light

Remove the screws securing the lamp lens. Remove lens and gasket. If the gasket is cracked replace with new. Depress the bulb, turn it counterclockwise in the socket and pull the bulb free of the socket. Insert the new bulb, depress and turn clockwise until the bulb stops.

### STORAGE BATTERIES

**CAUTION! Batteries give off highly inflammable gas. Never allow sparks or open flame near the batteries. Avoid spilling any electrolyte on hand or clothing.**

#### Maintenance

Proper battery maintenance will assure maximum service. Following are a few simple rules:

Keep battery cable terminals clean and tight.

Keep filler cap vent holes unplugged.

Replace worn, cracked, broken or corroded cables.

Keep batteries fastened securely in frame.

**NOTE:** *Excessive tightening can warp or crack battery case.*

Maintain the correct battery liquid level. Refer to "LIQUID LEVEL".

Keep the batteries clean. Refer to "CLEANING THE BATTERIES".

#### Cleaning the Batteries

If the top of a battery is dirty, it may be cleaned with a brush dipped in ammonia or soda solution. The vent plugs must be tightened and seled to prevent any solution from getting into the battery cells. After the foaming stops, flush off the battery with clean water and unseal the vent plugs. Brighten the terminal contact surfaces with steel wool or a stiff brush.

#### Liquid Level

The electrolyte in each cell must be at the proper level (6 to 13mm/1/4 to 1/2 in. above the plates) at all times to prevent battery failure. Check the level of the electrolyte. When the electrolyte is below this level, pure distilled water must be added. Never use hydrant water or any water which has been in metal container. Acid or electrolyte must never be added except by a skilled batteryman. Under no circumstance add any special battery "dopes", solutions or powders.

It is especially important to keep the batteries at full charge for cold weather operation. Add distilled water to the batteries in freezing temperatures only when the engine is to operate for several hours, to thoroughly mix the water and the electrolyte, or damage to the batteries will result from the water freezing.

## ENGINE LUBRICATING OIL FILTERS

The lubricating oil filters are a spin-on type. These filters cannot be cleaned and should not be disturbed except when it becomes necessary to replace them. Refer to "SCHEDULED MAINTENANCE GUIDE" in Section 7.

### REPLACEMENT

1. Park the machine on level ground and apply the parking brake. Run the engine until it reaches normal operating temperature then shut down the engine.

2. Allow ten minutes for the oil to drain back into the crankcase. Remove crankcase drain plug (Fig. 28).

3. After the oil has drained completely, reinstall the drain plug.

4. Clean the outside of the filters (Fig. 29) to prevent dirt from entering system while servicing.

5. Remove the spin-on filters by turning them counterclockwise. Discard the filters.

6. Apply a little engine oil to the seal and thread the filters on by hand. Turn clockwise until filter seal contacts the header, then turn the filter, by hand one full turn more. Do not use tools to tighten the filters

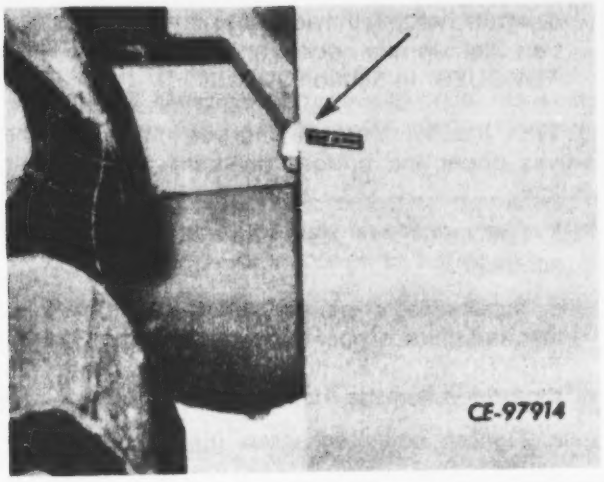



Fig. 28. Crankcase Drain Plug

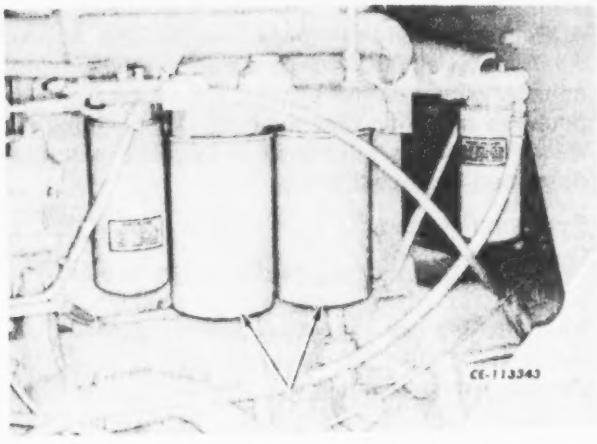



Fig. 29. Engine Lubricating Oil Filters

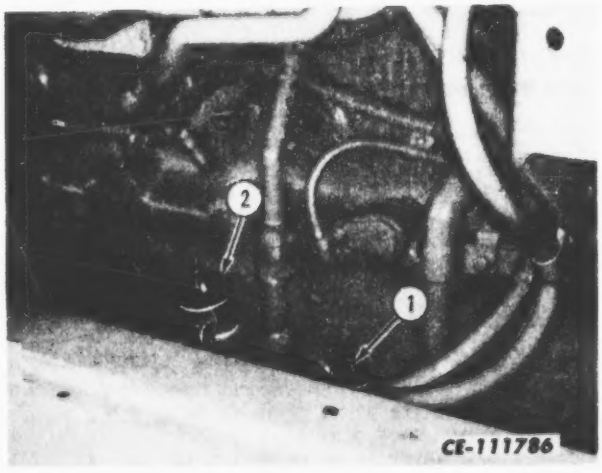



Fig. 30. Crankcase Oil Filler Cap and Level Gauge

1. Level Gauge
2. Filler Plug

7. Remove the oil filter plug (2, Fig. 30) and fill the crankcase with fresh oil. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in Section 7 for quantity and grade of oil specified. Install the filler plug.

8. Operate the engine at low idle for 5 to 10 minutes. Do not operate under load until normal oil pressure and temperature are reached. During warm-up, check the filters and crankcase drain plug for leakage.

## ENGINE VALVE CLEARANCE ADJUSTMENTS

Following this simplified procedure, all valves can be adjusted quickly and accurately. Note that the engine need not be cranked six times to position the piston of each cylinder on TDC. All valves are adjusted by cranking the engine only twice.

**CAUTION! Before making any adjustments place the electrical system master switch in the "OFF" position.**

**NOTE:** *Valve lash is adjusted with engine cold. The valves can be adjusted with the engine "hot", but the workmanship usually suffers due to the heat.*

1. Remove the cover and gasket from both cylinder heads. Turn the crankshaft until the number one piston is on the compression stroke and the timing pointer on the front cover is in line with the TDC mark on the vibration damper. Fig. 31 shows the numbering sequence of the valves. Refer to "HAND CRANKING" in this section.

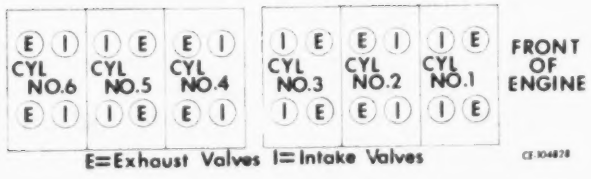



Fig. 31. Valve Arrangement

**NOTE:** *Be sure that the number one piston is on the compression stroke by turning both push rods by hand to determine that both intake and exhaust valves are closed. Valves are closed when push rods are loose and can be turned easily.*

2. Before adjusting the valve clearance, the valve bridge must be adjusted. Adjust the intake valve bridges for cylinders 1, 2 and 4 and exhaust valve bridges for cylinders 1, 3 and 5 as follows:

a. Loosen the bridge adjusting screw nut (1, Fig. 32) and back out screw (2) several times.

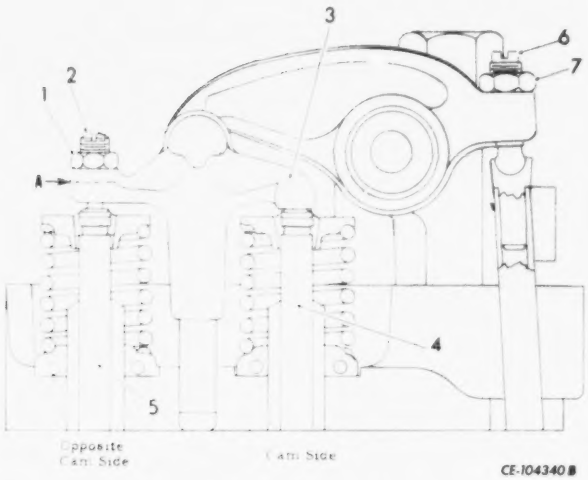



**Fig. 32. Sectional View of Valve Mechanism**

1. Bridge Adjusting Screw Nut
2. Bridge Adjusting Screw
3. Bridge
4. Cam Side Valve
5. Opposite Cam Side Valve
6. Rocker Lever Adjusting Screw
7. Rocker Lever Adjusting Screw Nut

b. Position fingers on bridge (3) directly above bridge guide and hold bridge down firmly against the cam side valve (4). Be sure the screw does not contact valve.

c. Turn screw (2) in until it just touches the valve. Turn screw an additional 20°-30° to insure uniform contact and to eliminate cocking of bridge on the guide.

d. While holding the adjusting screw in this position tighten the locknut. Refer to "SPECIAL TORQUES" in Section 9.

3. With the cylinders in this position adjust the valves under the bridges previously adjusted as follows:

a. Loosen rocker lever nut (7) and adjusting screw (6).

b. Insert a feeler gauge 9.5mm (3/8 in.) wide or less and of the proper thickness (refer to "SPECIFICATIONS" in Section 9) at point "A" between the bridge and the rocker lever.

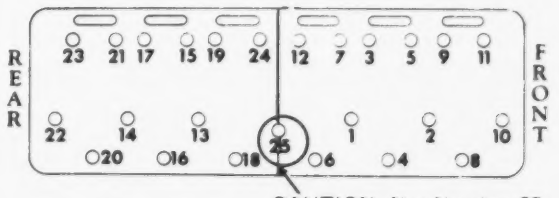
c. Tighten adjusting screw (6) until the feeler gauge is snug. While holding the screw in this position tighten nut (7). Refer to "SPECIAL TORQUES" in Section 9.

4. Rotate the camshaft one full revolution so the No. 6 cylinder is at TDC (compression). In this position adjust the intake valve bridges and valves for cylinders 3, 5 and 6 and the exhaust valve bridges and valves for cylinders 2, 4 and 6 in the same manner as described in steps 2 and 3.

5. Using new gaskets, install the valve covers.

## ENGINE CYLINDER HEAD

After the initial 100 hours of operation torque the cylinder head nuts in the sequence shown in Fig. 33. With the engine at operating temperature loosen one nut at a time (1/4 turn) and torque in rows as shown to 407 N.m (300 ft-lbs) except for nut #25 which is to be torqued to 543 N.m (420 ft-lbs).




CAUTION: Nut Number 25 has special torque re quirements.

Row 1: NUTS, 23, 21, 17, 15, 19, 24, 12, 7, 3, 5, 9, 11
Row 2: NUTS, 22, 14, 13, 25, 1, 2, 10
Row 3: NUTS, 20, 16, 18, 6, 4, 8

CE-107676B

**Fig. 33. Engine Cylinder Head Torquing Sequence**

# MAINTENANCE

## HAND CRANKING

**NOTE:** *An engine timing wrench to facilitate hand cranking can be made locally. Refer to Figs. 35 and 36.*

**CAUTION! Whenever hand cranking the engine, be sure to crank slowly. Never hand crank a warm or hot engine.**

This procedure is used for adjusting the valves.

1. Place the electrical system master switch in "OFF" position.

2. Place the transmission in neutral (N) and pull the engine shut-down handle out.

3. Position the wrench over the fan pulley and engage the timing wrench pin in one of the holes in the fan pulley (Fig. 34).

4. Crank the engine as required.

5. After adjustments have been completed, remove the timing wrench.

**Fig. 34. Timing Wrench Installed**

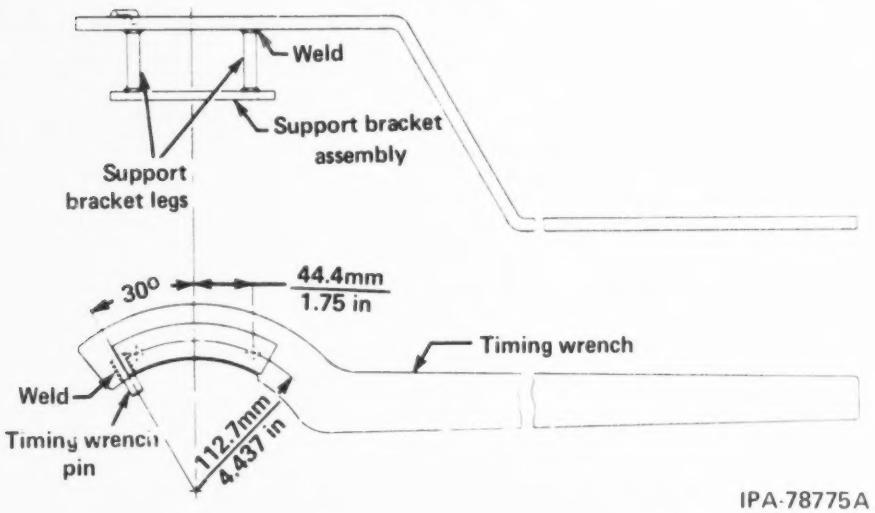



**Fig. 35. Timing Wrench**

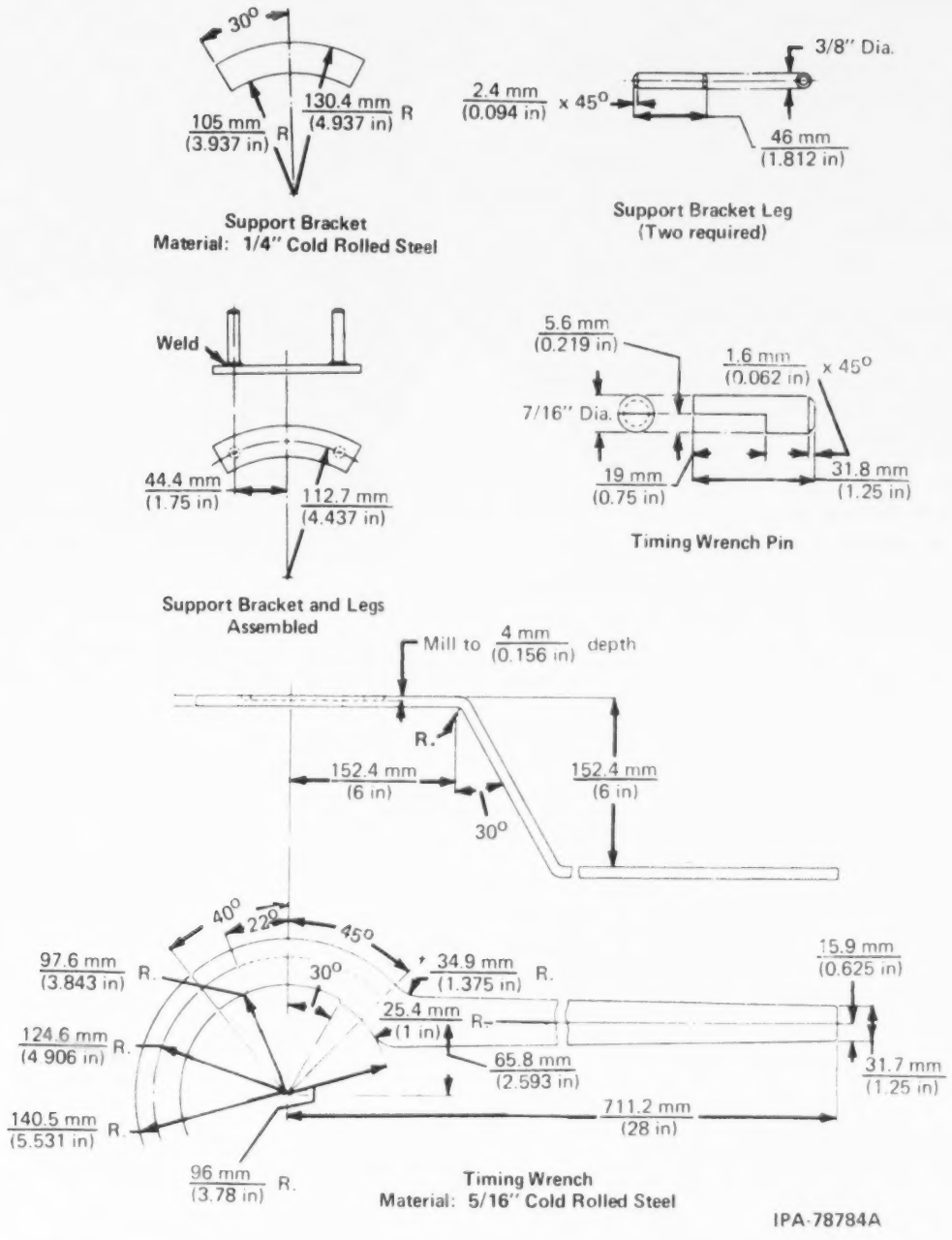



**Fig. 36. Detailed Instructions for Fabricating Timing Wrench**

## FUEL SYSTEM

### GENERAL

If a large stationary fuel storage tank is used, use a pump to remove fuel rather than a faucet. Provide a space of at least 76mm (3 in.) between the bottom of the pump suction pipe and the bottom of the storage tank for settling of sediment and water.

Locate a drain at the opposite end of the tank. Drain off the sediment and water regularly.

Do not use the last three inches of fuel in the supply tank; collect it in a container and allow it to settle. In this manner the sediment and foreign material can be separated from the fuel and disposed of with little or no loss of fuel.

**NOTE:** *Diesel fuel storage tanks and supply lines must never be galvanized, despite the fact that the zinc coating will reduce rust formation. Diesel fuel oil reacts chemically with zinc to form powdery flakes. These flakes can chip off causing damage to the fuel injection pump.*

| DIESEL FUEL SPECIFICATIONS (817C Engine) | |
|---|---|
| **Type of Operation** | **Preferred Specifications (*)** |
| Normal Service Above -12° C (10° F) | ASTM D-975 Grade 2-D ASTM D-396 Grade 2 |
| Below -12° C (10° F) or Extended Idling | ASTM D-975 Grade 1-D ASTM D-396 Grade 1 |

(*) ASTM refers to American Society for Testing and Materials. The D-396 fuels must also meet the cetane number and sulfur requirements of the D-975 specifications.

Optionally, the equivalent grades of recognized Federal Government specifications may be used — latest revisions of VV-F-800a.

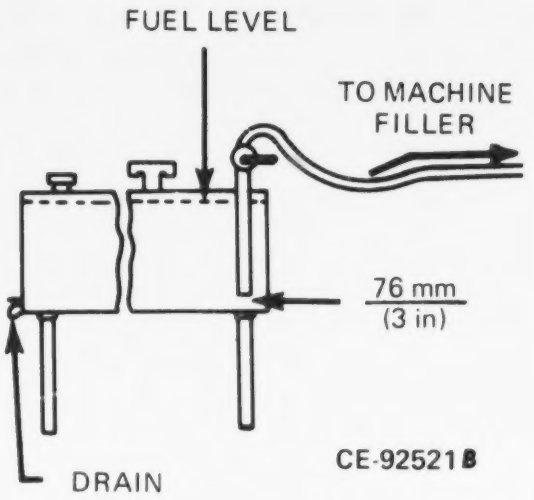



**Fig. 37. Fuel Storage Tank**

### FUEL INJECTION PUMP

**NOTE:** *Do not attempt to adjust the fuel injection pump.*

Unsatisfactory operation of the engine may not be due to the fuel injection pump. If unsatisfactory operation persists after servicing the filters; consult your PayLine Distributor to service the fuel injection pump. Special equipment and knowledge are required for prompt injection pump service; these are available at your distributor.

### DRAINING THE WATER FROM THE FUEL TANK

Drain water from the fuel tank by removing the plugs in the bottom of the tank. Replace the plugs when clean fuel begins to flow.

### FUEL FILTERS

The primary and final fuel filters are spin-on type filters. These filters cannot be cleaned and should not be disturbed except when it becomes necessary to replace them.

#### When to Replace the Filters

When the engine is misfiring or a loss of power is evident, replace the primary fuel filter. If the symptoms still persist, replace the final fuel filter.

**Replacing the Fuel Filters (Fig. 38)**

Keep new filters in the original package until ready for installation. Before loosening the filters clean the outside of the case and the filter head to prevent dirt or foreign material from entering the system.

1. Drain the water and sediment from the fuel tank.

2. Remove the primary or final fuel filter from the filter header by turning counterclockwise. A filter removal wrench can be used if unable to turn the filter by hand. Discard the fuel filter.

3. Thoroughly clean the filter header with kerosene or diesel fuel to prevent dirt or foreign material from falling into the new filter.

4. Apply a light coating of clean engine oil or chassis grease to the seal surface of the new filter.

5. Install, but do not "spin," the new filter, turning it until the seal just contacts the filter head.

6. Make aligning marks on the filter and the filter header; give the filter an additional 1/4 to 1/2 turn.

7. Vent the fuel system. Refer to "PRIMING AND VENTING THE SYSTEM" in this section.

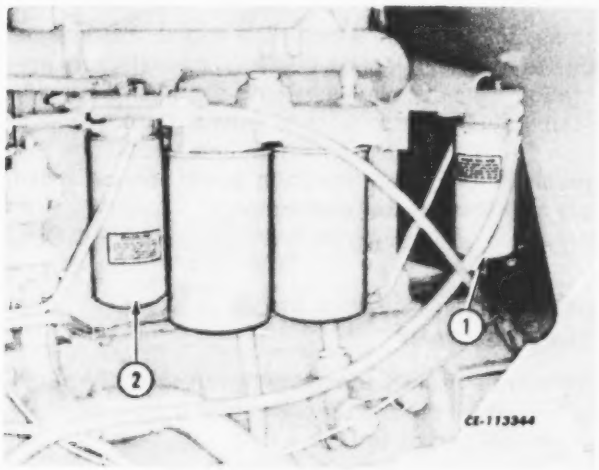



**Fig. 38. Fuel Filters**

1. Primary Fuel Filter 2. Final Fuel Filter

**PRIMING AND VENTING THE SYSTEM**

All air must be eliminated from the fuel lines before the engine will operate properly. All fuel line connections must be tight to prevent leakage and to prevent air from entering the system. The system must be vented when:

An engine, in operation, runs out of fuel.

Fuel filters have been replaced.

Fuel piping has been disconnected or loosened.

Vent the system as follows:

1. Fill the fuel tank.

2. Unlock the plunger of hand priming pump (1, Fig. 39) by rotating counterclockwise.

3. Open vent (2) on the final filter.

4. Pump fuel into the system using the pump plunger until a stream of fuel comes out of the final filter vent.

5. Close the vent on the final filter.

6. Lock the priming pump plunger by pressing in and rotating clockwise until tight.

**CAUTION! If priming pump plunger is not tight, it will back out due to vibration during operation and it will literally blow out.**

7. Start the engine. With engine at low idle, reopen vent on final filter and allow fuel to flow until free of air bubbles.

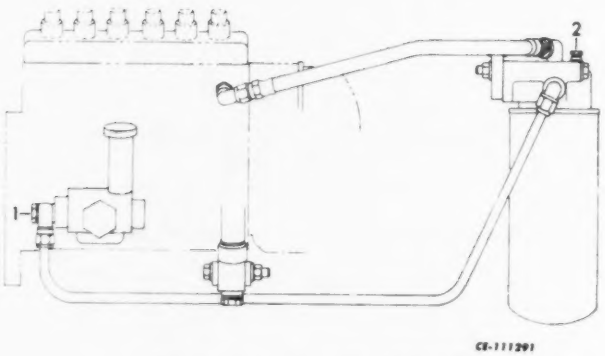



**Fig. 39. Priming and Venting Points**

1. Hand Priming Pump 2. Final Filter Vent

## ETHER INJECTOR (If Equipped)

**CAUTION! Observe the precautions printed on the starting ether container when using or storing this fluid and when discarding the empty containers.**

**NOTE:** *Improper starting fluids can cause valve seizure and severe damage to the engine. Consult your PayLine Distributor for the recommended starting fluid to be used.*

### INSPECTION AND CLEANING

Make certain that ether is available under pressure. To do so, remove the ether container and check if a good spray is obtained. If not, replace with a new container. If a good spray was obtained, reinstall the container and test the ether injector as follows:

a. Disconnect the ether tube at the spray nozzle in the engine manifold. Remove the spray nozzle.

b. Reconnect the nozzle to the tube.

c. Direct the nozzle away from the engine and actuate the ether injector.

d. Dribbling or no spray indicates a blocked spray nozzle or tube. If necessary clean or replace spray nozzle and/or tube.

### CHANGING THE FLUID CONTAINER

1. Loosen the nuts securing the fluid container support saddle.

2. Unscrew and discard the container from the ether starting valve.

3. Install the new container in the valve.

4. Secure the container in place by tightening the saddle nuts. Do not overtighten the nuts.

## AXLES

### CHANGING THE OIL

**NOTE:** *Both front and rear axles are drained and filled in the same manner.*

1. Operate the machine until normal operating temperature is reached. Park the machine on level ground, completely lower the bucket, apply the parking brake and shut down the engine.

2. Remove the drain plug (1, Fig. 40) and filler plug (2).

3. After the oil stops draining install the drain plug.

**NOTE:** *Move the machine only enough to properly locate the planetary drain plug.*

4. Move the machine so the planetary drain plug is in the position shown in Fig. 41.

5. Shut down the engine and apply the parking brake.

6. Remove the planetary drain plug.

7. After the oil stops draining install the plug.

8. Repeat steps 4 through 6 for the opposite planetary on the same axle.

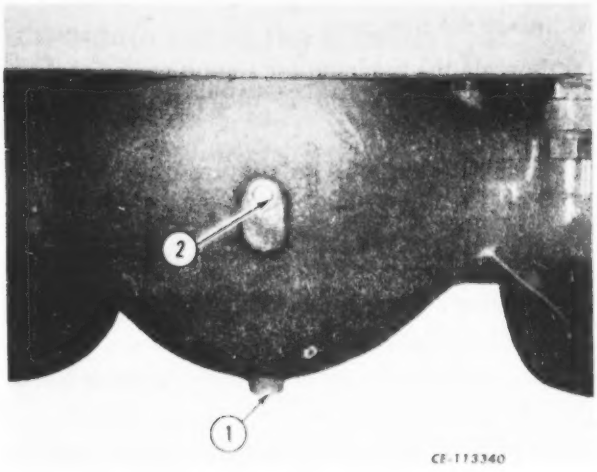



**Fig. 40. Axle Drain and Filler Plug**

1. Drain Plug 2. Filler Plug

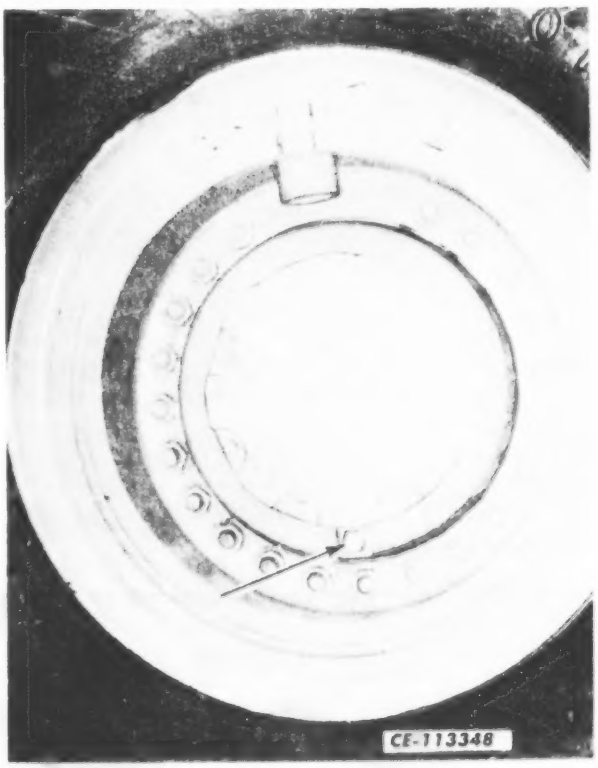



**Fig. 41. Planetary Drain Plug**

9. Fill the axle up to the bottom of the filler hole. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in Section 7 for grade of oil specified.

10. Install the filler plug.

11. Operate the machine for a short period of time so the oil can work into the gears throughout the axle and planetaries.

12. Check the oil level and add oil necessary to bring the level up to the filler plug hole.

### CLEANING THE AXLE BREATHER (Fig. 42)

1. Completely lower the bucket, apply the parking brake and shut down the engine.

2. Unscrew the breather and clean in a commercial solvent.

3. Dry breather with compressed air and install.

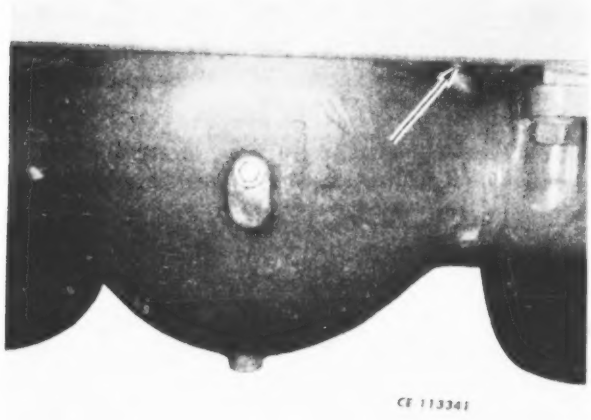



**Fig. 42. Axle Breather**

## TRANSMISSION

### CHANGING THE OIL

1. After reaching operating temperature, park the machine on level ground. Lower the bucket to the ground, apply the parking brake and shut the engine down.

2. Install the safety bar.

3. Place a container under the transmission to catch the oil.

4. Remove the drain plug (3, Fig. 43) from the transmission immediately after operation while the lubricant is still warm.

5. Unscrew the transmission oil level gauge and remove. This will vent the case and allow the oil to drain faster.

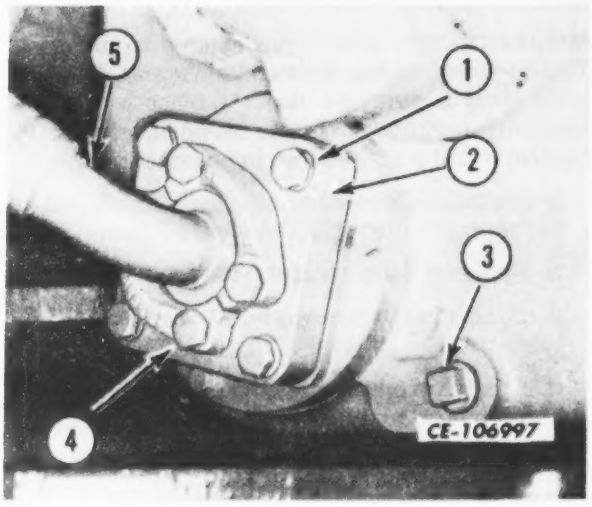



**Fig. 43. Transmission Sump Strainer and Drain Plug**

6. Open the vent valve (Fig. 44) on the top right side of the transmission and torque converter oil cooler. The cooler is mounted to the rear of the radiator.

7. After the lubricant has drained, service the transmission filter element. Refer to "CHANGING THE FILTER ELEMENT" in this section.

8. Install the transmission drain plug. Close the oil cooler vent valve.

9. Loosen the split flange clamp bolts (4, Fig. 43) and disconnect the hose (5) from the sump strainer (2) and move it out of the way.

10. Loosen the bolts (1) and remove the strainer assembly from the transmission.

11. Remove the gasket from between the strainer and the housing. Remove all gasket material from the metal surfaces.

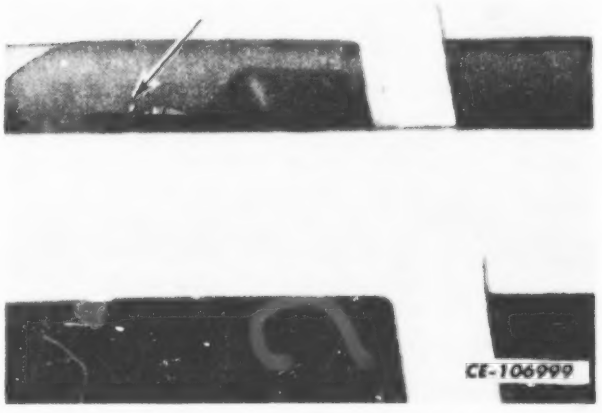



**Fig. 44. Oil Cooler Vent Valve**

12. Unscrew the strainer (2, Fig. 45) from the valve portion (1) of the strainer assembly.

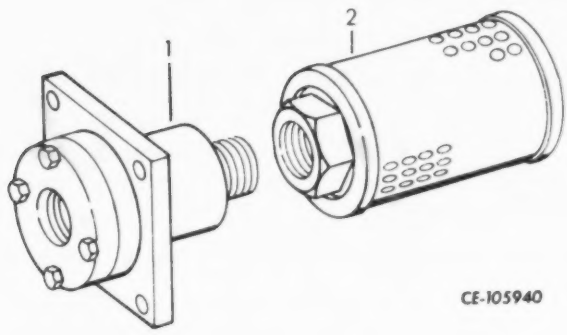



**Fig. 45. Sump Strainer Assembly**

13. Look down inside of the pipe portion of the valve and inspect the spring for breakage.

14. Push down on the stem inside of the pipe and inspect the mating surface of the rubber disc for excessive wear. Replace the valve assembly if necessary.

15. Wash the valve assembly and strainer in a commercial cleaning solvent. Remove all metal particles from the magnetic rods on the strainer. If necessary, the rods may be removed. Dry the parts with compressed air if available.

16. Assemble the strainer onto the valve assembly.

17. Install a new gasket over the strainer and line the holes up with the retaining plate mounting holes.

18. Install the strainer assembly into the transmission and secure in place with the bolts previously removed.

19. Attach hose (4) to the sump strainer and secure with the split flange clamps.

20. Fill the transmission with fresh lubricant through the fill-check pipe. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in Section 7 for the grade and quantity of lubricant specified.

21. Install the transmission level gauge and check oil level as described in Section 7.

## CHANGING THE FILTER ELEMENT

The filter is located on the left hand side of the machine. Refer to Fig. 46.

1. Drain the transmission oil as described under "CHANGING THE OIL" in this section.

2. Clean the area around the filter head (1, Fig. 47). Remove the drain plug (4). After the filter has drained install the plug.

3. Remove the four screws securing body (5) to the head. Separate the body from the head.

4. Remove element (3) from the body. Remove and inspect "O" rings (6) and seal ring (2); replace if worn or deteriorated.

5. Clean the body in a commercial cleaning solvent and dry thoroughly.

6. Using a new element (3) assemble the filter in the reverse order it was disassembled.

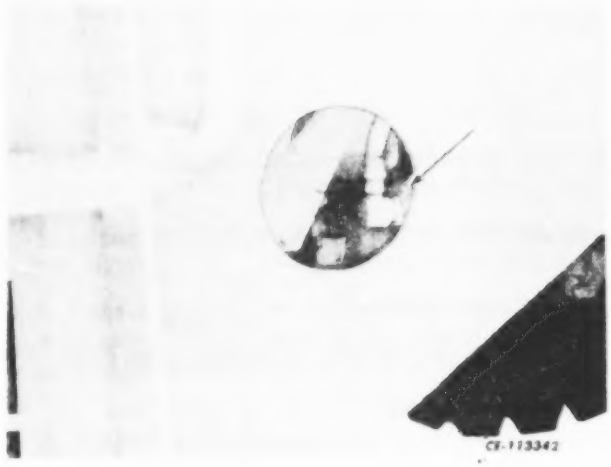



**Fig. 46. Transmission Filter**

## CLEANING THE TRANSMISSION BREATHER (Fig. 48)

The breather is located at the top of the transmission in the housing.

Unscrew the breather to remove and clean it in a commercial solvent. Dry the breather with compressed air and install.

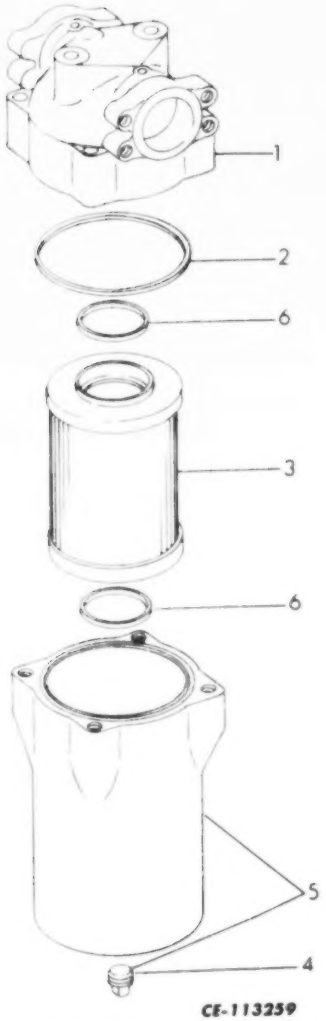



**Fig. 47. Exploded View of Transmission Filter**

1. Filter Head
2. Seal Ring
3. Element
4. Drain Plug
5. Filter Body
6. "O" Ring

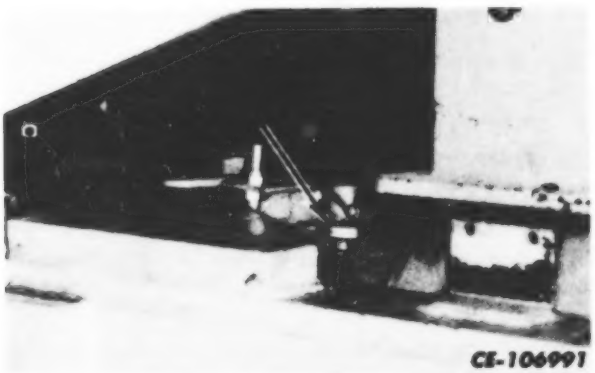



**Fig. 48. Transmission Breather**

## HYDRAULIC SYSTEM

### DRAINING THE SYSTEM (Fig. 49)

1. Operate the boom, bucket and steering until the hydraulic oil becomes warm.

2. Park the machine on level ground.

3. Raise the bucket completely and roll the bucket back all the way.

**CAUTION! Do not allow anyone under the boom and bucket while in the raised position.**

4. Shut the engine down and apply the parking brake.

5. Clean the top of the reservoir with kerosene or cleaning solvent.

6. Slowly loosen and remove the reservoir filler cap (1).

**CAUTION! Always loosen the filler cap slowly to relieve pressure build-up in the system.**

7. Remove the pipe plug (26) in the drain valve (25).

8. Fit a short 3/4" threaded pipe into the end of a piece of hose. Screw the pipe into the drain valve. Put the other end of the hose into a container large enough to hold all of the fluid from the reservoir.

9. Open the drain valve and allow the reservoir to drain.

10. Close the reservoir drain valve.

11. Lower the boom slowly. After the boom comes to rest on the ground push the bucket lever forward and let the bucket down slowly. This will force the hydraulic oil out of the boom and bucket cylinders and into the reservoir.

12. Open the reservoir drain valve.

13. Allow the reservoir to drain completely, then close the drain valve. Remove the drain pipe and hose from the drain valve. Install plug (26).

14. Remove the drain plug (23) from the reservoir. Allow the bottom of the reservoir to drain then reinstall the plug.

### SERVICING THE RESERVOIR FILTERS (Fig. 49)

1. Drain the reservoir as described under "DRAINING THE SYSTEM" in this section.

2. Loosen retainer bolts (4) enough to facilitate removal of cover (14).

# MAINTENANCE

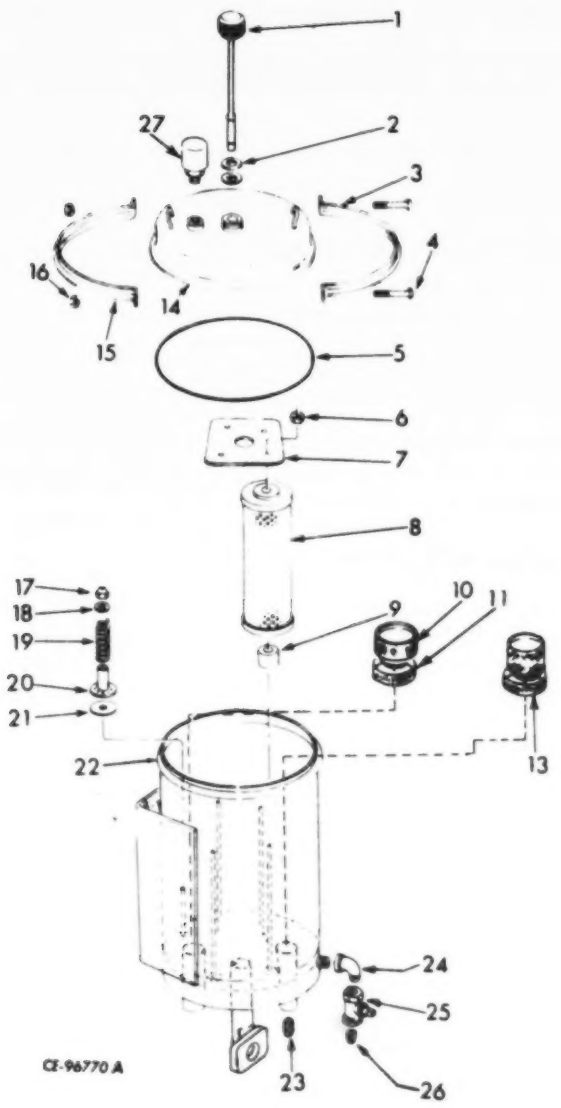



**Fig. 49. Exploded View of Hydraulic Reservoir**

1. Oil Level Gauge
2. Level Gauge Seal
3. Cover Retainer
4. Retainer Bolts
5. Seal Ring
6. Nut
7. Filter Retainer
8. Filter
9. Spacer
10. Screen
11. Clamp
12. Screen
13. Clamp
14. Reservoir Cover
15. Clamp
16. Nut
17. Nut
18. Washer
19. Spring
20. Sleeve
21. Insulator
22. Reservoir
23. Plug
24. Elbow
25. Drain Valve
26. Plug
27. Relief Valve

3. Lift off the cover and remove seal ring (5).

4. Remove nuts (6), plate (7) and filters (8).

5. Loosen clamps (11 and 13) and remove screens (10).

6. Clean screens (10) in a commercial solvent and dry with compressed air. Install the screens and secure with clamps (11 and 13).

7. Install new elements (8) and plate (7). Secure with nuts (6).

8. Inspect seal ring (5). If deteriorated or damaged replace with new. Install seal ring on reservoir rim.

9. Install cover (14) and secure cover with retainer band (15).

10. Fill the reservoir. Refer to "FILLING THE SYSTEM" in this section.

## FILLING THE SYSTEM

1. Remove the reservoir filler cap and dipstick.

2. Fill the reservoir with clean oil up to the "H" mark on the dipstick. Refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" in Section 7 for grade of oil specified.

3. Install and tighten the reservoir filler cap.

4. Start the engine and operate the boom and bucket several times to fill the hydraulic cylinders with oil.

5. Lower the bucket to the ground and shut down the engine.

6. Slowly remove the reservoir filler cap and dipstick and check oil level. Fill the reservoir as necessary to bring the level up to the "H" mark on the dipstick.

7. Install the filler cap and tighten. Check the reservoir for leakage.

## SERVICING THE RESERVOIR BREATHER

**CAUTION! Always loosen the filler cap slowly to relieve pressure build-up in the system.**

1. Loosen filler cap (1, Fig. 49) to relieve system pressure.

2. Remove lock ring (2, Fig. 50) and cover (4).

3. Remove the filter (5) and clean in a commercial solvent and dry with compressed air.

4. Check seal rings (3) for wear or deterioration. Replace if necessary.

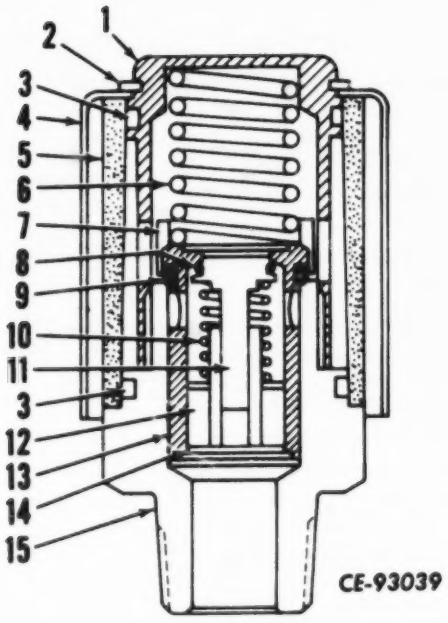



**Fig. 50. Hydraulic Reservoir Breather**

1. Cap
2. Ring Lock
3. Filter Seal
4. Cover
5. Filter
6. Spring
7. Retainer
8. Seal Poppet
9. Seal Sleeve
10. Spring Poppet
11. Poppet
12. Guide
13. Sleeve
14. Ring Lock
15. Body

5. Reinstall filter (5) and cover (4). Secure cover with ring (2).

6. Tighten the reservoir filler cap.

## SEAT BELT

**CAUTION! Do not bleach or redye color of webbing as same may cause a severe loss of tensile strength.**

Keep belts flat to avoid twisting and roping when not being used. Do not place heavy or sharp objects on the belts.

The entire seat belt assembly should be inspected periodically for corrosion, wear, fraying or weak spots. The seat belt mounting bolts should also be periodically inspected for looseness.

## TIRES AND WHEELS

Avoid parking the machine in puddles of oil, gasoline or grease.

Check inflation pressures with an accurate tire pressure gauge when the tires are cool. Refer to "SPECIFICATIONS" in Section 9. Install the valve caps.

Never vent built-up pressure in a tire, such as encountered on extremely hot days. Pressure built up on hot days actually protects the tires by avoiding excessive side wall flexing and heat which are detrimental to tire life. Venting tires will also result in underinflation when the tire cools.

Wheel rim components should be checked to assure no damage or cracks are present. Damaged parts are to be replaced, NOT repaired.

### UNDER INFLATION

Too little air pressure increases deflection, causes the tire to wipe and scuff over the road, results in extra strain on the tire, and increases the chances for bruising.

### PROPER INFLATION

Maintaining the proper air pressure provides maximum road contact and results in increased tire life.

### OVER INFLATION

Over inflation reduces tire deflection and tire contact area, causing the tire to ride on the crown, and results in rapid wear in the center of the tread.

### WHEEL LUG NUTS

Check torque every 10 hours of operation for new machines or newly installed wheels until torque stabilizes; check every 100 hours thereafter.

## TURBOCHARGER

### PRECAUTIONS

As a precaution against dirt getting into the engine, frequently inspect the flexible rubber hose connections clamped to the turbocharger compressor housing. If signs of deterioration are evident, replace immediately.

To eliminate undue strain on the rubber hose connections, insure that pipes are properly aligned.

## PRIMING THE TURBOCHARGER

The turbocharger must be primed when the engine has been idle for 30 days or more. Prime the turbocharger as follows:

1. Turn the electrical system master switch "ON".
2. Be sure the parking brake is applied.
3. Be sure the transmission directional lever is in the neutral (N) position.
4. Pull out the engine shut-down handle.
5. Turn the ignition and light switch to the start position. Crank engine until oil pressure reading is indicated on the engine oil pressure gauge. This should provide an adequate amount of oil to lubricate the turbocharger.

**NOTE:** *Cranking the engine should be limited to 30 second intervals as outlined under "STARTING THE ENGINE" in Section 3.*

## CLEANING THE MACHINE

Remove dirt from the engine, transmission, hydraulic cylinders, axle and hydraulic connections. If allowed to accumulate, the dirt will find its way into the tractor components when plugs and covers are removed. Dirt caked over axle transmission and engine breathers will cause oil losses.

Steam is the most effective means of cleaning dirty equipment. If steam is not available, use a spray of mineral spirits or a similar solvent. Steam can be harmful to electrical components. Protect the generator or alternator and cranking motor openings from the full force of the steam jet. If a solvent spray is used, it must not be injurious to the hydraulic hoses, engine fuel lines or the insulation on electric wires. Apply fresh grease at all fittings on the tractor after cleaning.

# SPECIFICATIONS AND CAPACITIES

## CAPACITIES (APPROXIMATE)

| | |
|---|---|
| Axles (each) | 42.5 litres (45 qts) |
| Crankcase w/Filter | 30.3 litres (32 qts) |
| Fuel Tank | 435.3 litres (115 gals) |
| Hydraulic Reservoir | 208.2 litres (115 gals) |
| Transmission w/Filters | 42.5 litres (45 qts) |
| Intermediate Drive Reservoir | 0.47 litre (1 pt) |

## SPECIFICATIONS

| | |
|---|---|
| Make and Model | International, DT 817 Series C |
| Type | Turbocharged, 4-cycle diesel |
| No. of Cylinders | 6 |
| Bore | 137mm (5-3/8 in.) |
| Stroke | 152mm (6 in.) |
| Displacement | 13.2 litres (817 cu. in.) |
| Engine Speeds: | |
| Full Load Governed | 2100 rpm |
| Low Idle | 800-900 rpm |
| High Idle | 2350-2500 rpm |
| Operating Idle | 1200-1300 rpm |
| Rated Power | 239 kw (320 hp) |
| Valve Clearance: | |
| Intake | 0.51mm (0.020 in.) |
| Exhaust | 0.79mm (0.031 in.) |
| Belt Tension: | |
| Alternator | 311 to 334 N (70 to 75 lbs) |
| Air Compressor | 423 to 445 N (95 to 100 lbs) |

### ELECTRICAL SYSTEM

| | |
|---|---|
| Voltage | 24 volt — neg ground |
| Batteries | Four-6 volt |
| Alternator | 30 amp |
| Torque Converter: | |
| Type | Single stage, single phase |
| Stall Ratio | 2.08:1 |
| Transmission: | |
| Make | International Harvester |
| Model | P-2004 |
| Type | Four speed, constant mesh, full reversing, full power shift |
| Axles: | |
| Make | International Harvester |
| Model | FR-150 |
| Type | Planetary |

### BRAKES

| | |
|---|---|
| Service: | |
| Type | Axles by axle, air over hydraulic, wedge type internal expanding shoe |
| Parking: | |
| Type | Expanding shoe |

# SPECIFICATIONS AND CAPACITIES

## HYDRAULIC SYSTEM

Steering Circuit:
- Pump:
  - Type ..... Vane
  - Capacity ..... 174 litres/min. (46 gpm) at full engine gov. speed
- Cylinders:
  - Quantity ..... 2
  - Bore ..... 114.3mm (4.5 in.)
  - Stroke ..... 520.7mm (20.5 in.)

Loader Circuit:
- Pump:
  - Type ..... Vane
  - Capacity ..... 390 litres/min. (103 gpm) at full engine gov. speed
- Cylinders:
  - Boom:
    - Quantity ..... 2
    - Bore ..... 152.4mm (6 in.)
    - Stroke ..... 1270mm (50 in.)
  - Bucket:
    - Quantity ..... 1
    - Bore ..... 203.2mm (8 in.)
    - Stroke ..... 546mm (21.5 in.)
  - Action Time (empty):
    - Boom Raise ..... 7.15 sec.
    - Boom Lower (float) ..... 5.1 sec.
    - Bucket Roll Back ..... 2.7 sec.
    - Bucket Dump ..... 1.6 sec.

## TIRES

Size and Inflation Pressures:
- Standard ..... 26.5 x 25 — 14 ply (L3) 241 kPa (35 psi)
- Optional ..... 26.5 x 25 — 20 ply (L4) 345 kPa (50 psi)
- Optional ..... 29.5 x 25 — 22 ply (L3) 345 kPa (50 psi)
- Optional ..... 29.5 x 25 — 22 ply (L4) 345 kPa (50 psi)
- Optional ..... 26.5 x 25 — 20 ply (L3) 345 kPa (50 psi)

## GENERAL

- Weight ..... 21,177 kg (46,688 lbs)
- Length ..... 8.42m (331.5 in.)
- Width ..... 3.12m (123 in.)
- Height ..... 3.8m (149.8 in.)
- Ground Clearance ..... 0.59m (23.2 in.)
- Wheel Base ..... 3.56m (140 in.)
- Steering Angle ..... 40°
- Steering Radius ..... 7.11m (280 in.)
- Bucket (standard):
  - Capacity ..... 3.44m$^3$ (4.5 c.y.)
  - Cutting Edge ..... 3.31m (130.5 in.)
  - Dump Angle ..... 45°

## SPECIAL TORQUES

All torques are given with bolts, screws and nuts lubricated with engine oil unless otherwise indicated.

Engine Cranking Motor Mounting Bolts ..... 142-136 N.m (105-120 ft-lbs)
Engine Cylinder Head Mounting Nuts* (all except No. 25) ..... 407 N.m (300 ft-lbs)
Engine Cylinder Head Mounting Nut* (No. 25) ..... 543 N.m (420 ft-lbs)
Engine Thermostat Housing Mounting Screw ..... 45-50 N.m (35-37 ft-lbs)
Engine Valve Bridge Adjusting Screw Nuts* ..... 47 N.m (35 ft-lbs)
Engine Valve Rocket Lever Adjusting Screw Nuts* ..... 115 N.m (85 ft-lbs)
Wheel Lug Nuts ..... 1,186-1,254 N.m (875-925 ft-lbs)

*A torque value of plus or minus 5% of the value shown should be achieved for satisfactory application.

## TORQUE VALUES FOR STANDARD FASTENERS

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Catalog for the machine involved. *DO NOT SUBSTITUTE*. Original equipment standard hardware is defined as IH Type 8, coarse thread bolts and nuts and thru hardened flat washers (Rockwell "C" 38-45), all phosphate coated and assembled without supplemental lubrication (as received condition).

The torques shown below also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.

2. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts).

3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade *ONLY* and are *NOT* to be used to determine required torque.

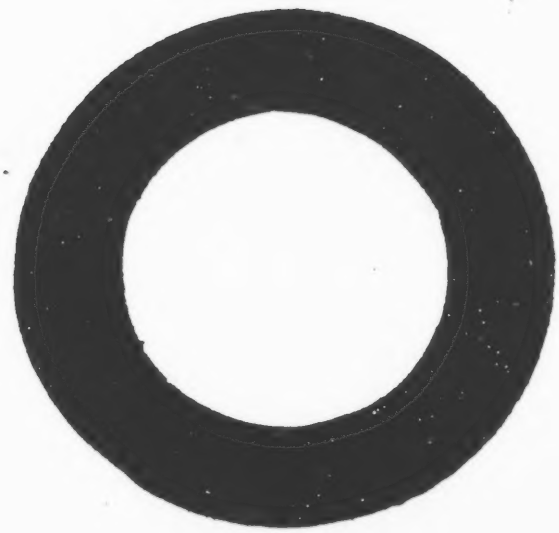
| NOMINAL THREAD DIAMETER | STANDARD TORQUE ±10% | |
|---|---|---|
| | FOOT LBS. | NEWTON METERS |
| 1/4 | 7 | 10 |
| 5/16 | 14 | 19 |
| 3/8 | 24 | 32 |
| 7/16 | 38 | 51 |
| 1/2 | 60 | 80 |
| 9/16 | 80 | 110 |
| 5/8 | 115 | 155 |
| 3/4 | 200 | 270 |
| 7/8 | 320 | 440 |
| 1 | 480 | 650 |
| 1-1/8 | 590 | 800 |
| 1-1/4 | 830 | 1100 |
| 1-3/8 | 1100 | 1500 |
| 1-1/2 | 1400 | 1900 |
| 1-3/4 | 2300 | 3100 |
| 2 | 3400 | 4600 |

# SPECIFICATIONS AND CAPACITIES

## TORQUE VALUES FOR HOSE CLAMPS

The following chart provides the tightening torques for hose clamps used in all rubber applications (radiator, air cleaner, operating lever boots, hydraulic system, etc.).

| CLAMP TYPE & SIZE | TORQUE PLUS OR MINUS 5% | | | |
|---|---|---|---|---|
| | RADIATOR, AIR CLEANER, BOOTS, ETC. | | HYDRAULIC SYSTEM | |
| | INCH LBS. | NEWTON METERS | INCH LBS. | NEWTON METERS |
| "T" Bolt (Any Diameter) | 60 | 7 | 45 | 5 |
| Worm Drive — 1-3/4" Open Diameter & Under | 25 | 3 | 45 | 5 |
| Worm Drive — Over 1-3/4" Open Diameter | 45 | 5 | 45 | 5 |



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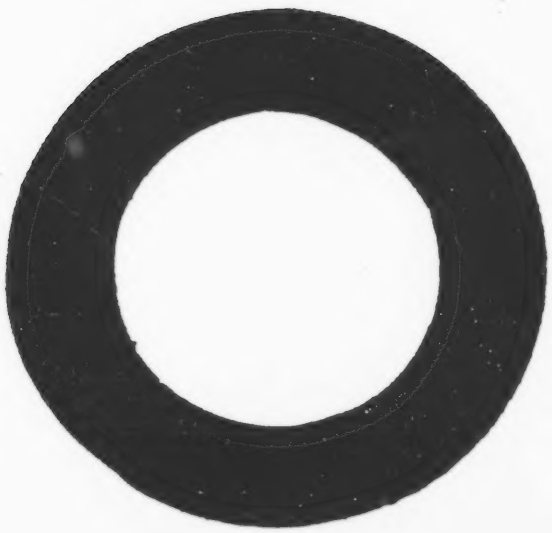

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# INTRODUCTION

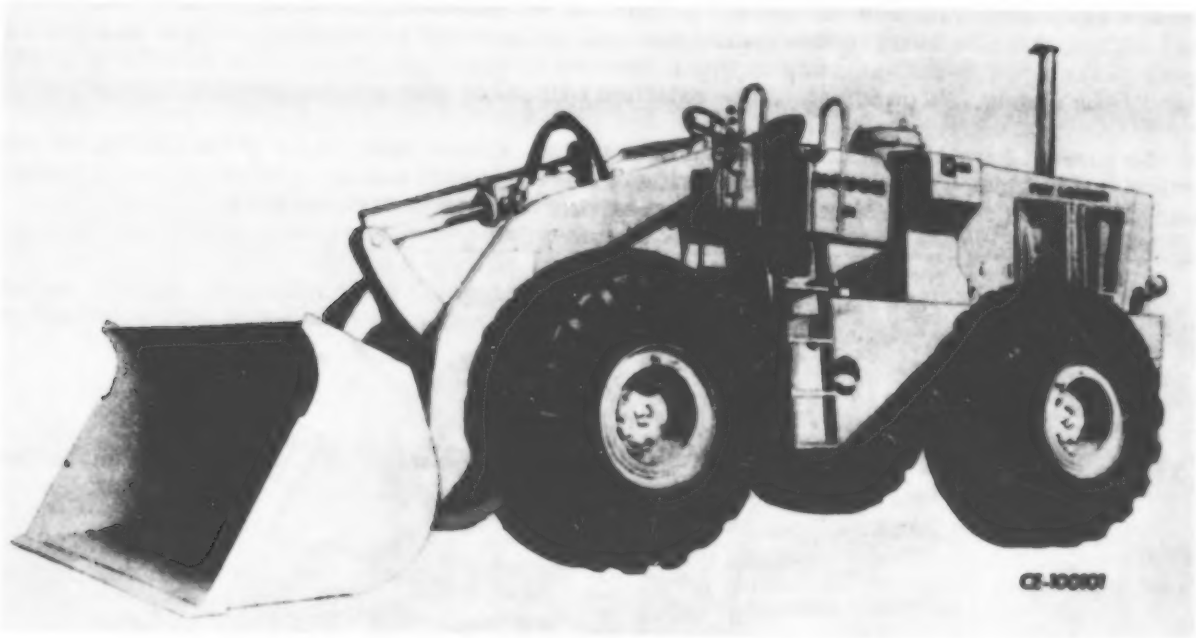


## GENERAL

The instructions contained in this service manual are for the information and guidance of servicemen responsible for the overhaul and repair of the Model H-100C PAY loader.

This manual provides the serviceman with fast, convenient reference to information on operation, maintenance and repairs, as well as descriptions of the major units and their functions in relation to other components of the PAY loader.

Each section of the manual is provided with a contents page, and where applicable, a paragraph showing special torques and specifications necessary for inspection and/or assembly. A general specification table and a standard torque chart are provided in this section.



Model H-100C

# INTRODUCTION

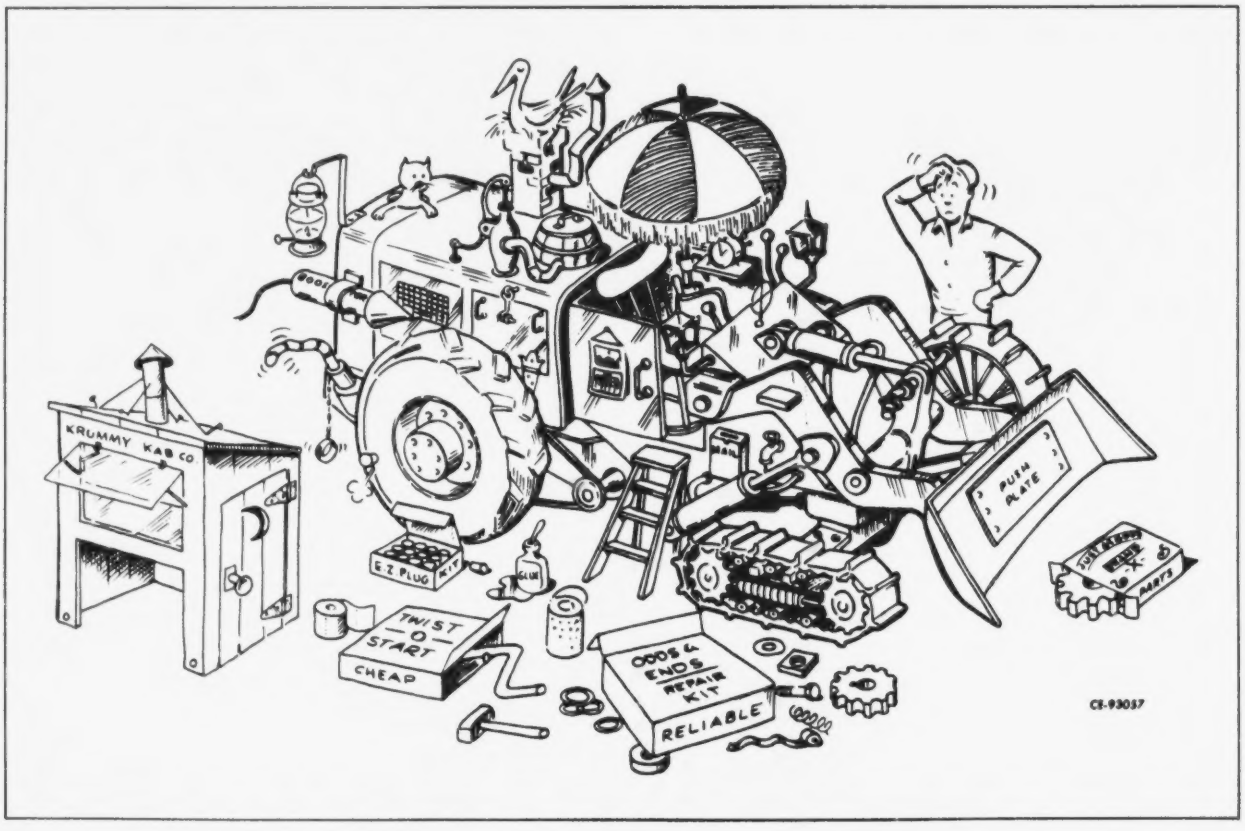
## LUBRICATION

Instructions on the lubrication of each assembly are given in the Lubrication Chart in the Operator's Manual. When assembling any parts, always coat all wearing surfaces with the lubricant specified in the chart. Except for such installations as taper pins, etc. whose surfaces should be clean and dry, use sufficient quantities of lubricant to prevent any danger of seizing, scoring or excessive wear when the assembly is first operated. Failure to provide "starting lubrication" may result in serious damage.

## SERVICE PARTS

IH and Hough Construction Equipment deserves genuine service parts. The best material obtainable and experience gathered through many years of manufacturing power equipment, enable International and Hough to produce quality that will not be found in imitation or "just as good" repair parts. No serviceman can afford to guarantee a repair job that is not serviced with genuine IH and Hough parts. No owner should be satisfied with other than genuine parts.

For the correct service parts to be used on a machine, always refer to the parts catalog for that particular machine. The loose-leaf parts catalogs are accurate and are continually being brought up-to-date by the issuance of new pages covering any changes in part numbers.

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## SERIAL NUMBERS

The tractor serial number plate is stamped on a plate and located on the left front side of the operator's compartment.

The IH diesel engine serial number is stamped on the left side of the block near the flywheel housing.

The Cummins diesel engine serial number is stamped on a plate located on the fuel pump housing.

## ENGINE

The Model H-100C PAY loader may be equipped with a IH DT-817B diesel engine or a Cummins NT-855C diesel engine. Instructions for removal and installation of the engines are covered in this manual. For detailed information on overhauling and adjusting the IH DT-817B diesel engine, refer to Service Manual ISS-1519.

## ENGINE WARRANTY

International and Hough make no warranty in respect to the Cummins diesel engine in the Model H-100C PAY loader. The Cummins engine is warranted by the Cummins Engine Company, Inc., Columbus, Indiana. Servicing of the Cummins engine during the warranty period is to be handled by the Cummins distributor or dealer in your locality.

## DIESEL FUEL SYSTEM

If detailed information on the fuel system of the IH DT-817B diesel engine is desired, refer to the Injection Pump Manual, ISS-1522.

If detailed information on the fuel system of the Cummins NT-855C diesel engine is desired, refer to the distributor or dealer in your area.

## SERVICE TOOLS

The design of IH and Hough Construction Equipment machines requires a minimum of service tools other than those in the mechanic's tool kit. Whenever the application of inexpensive special service equipment will facilitate work, it is shown. Otherwise, it is assumed that servicemen will select from their tool kits as required. Information regarding special tool equipment is given in the "Service Tool Manual" ISS-1002. The IH and Hough Construction Equipment distributors have most of this equipment and are in an excellent position to service these PAY loaders.

## GASKETS AND SEALS

Always use new gaskets and seals. When installing a leather seal, be careful to install it as specified in the instructions. Be extremely careful not to damage the seal in any way during installation.

Do not "roll" an "O" ring seal during installation. To correctly install the "O" ring, position the ring at one point and using a blunt, narrow tool, stretch the "O" ring into position (refer to Fig. I-1).

Figure I-1
Correct "O" Ring Installation.

## RECOMMENDED BEARING PROCEDURES

### NEW BEARINGS

Keep bearings in original cartons or wrappings until ready for use. If package is opened and bearing is not used immediately, protect it by re-wrapping.

Before wrapping and packing, bearings are carefully cleaned by the manufacturer and are thoroughly coated with a protective lubricant.

Keep bearings clean and away from moisture.

Handle bearings with clean hands and use clean tools. Handle bearings as little as possible. Finger marks are hard to wash off and perspiration starts corrosion.

Don't wash the oil or grease out of a new bearing.

Don't take new bearings apart. They were assembled correctly in the first place.

### BEARING REMOVAL

Wash off bearing housing; take care to prevent loose dirt from entering the housing.

Take a few moments to study the assembly. Determine the best way to undertake bearing removal.

Be careful and avoid damage. The bearings may be good enough to use again.

The best tool for removing a bearing is usually an arbor press. Most field work however, is done with some type of bearing puller. Where required, this manual will refer to the correct tool to employ. Use it for speed and safety.

To remove a bearing, press or pull only on the race that is tight.

Press or pull straight and square to keep the race from cocking and scoring the shaft or damaging the bearing.

Never press or pull against bearing shields or separators.

Keep the press table and support blocks clean and square. Provide some means to keep the shaft from falling on the floor. Protect the end of the shaft with a pad of lead, copper or other soft metal or a hardwood block.

Use pullers properly. Set them up so that they will push or pull straight and square. Take care not to damage shaft threads, keyways or shoulders in the process.

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## RECOMMENDED BEARING PROCEDURES

With proper care, bearings may be removed quite safely with improvised methods when the right tools are not available.

A vise may do in place of an arbor press and a drift can take the place of the press ram. If the shaft is held in a vise, protect its surface with copper sheet or hardwood blocks.

A suitable block, placed over the end of a tube type driver, will allow the hammer blows to be struck in dead center. This will prevent the bearing from cocking.

If bearing fit does not permit the use of a bearing puller or arbor press the bearing will have to be cut off. Cut the outer race and ball retainer with an acetylene torch. Burn the inner race only part way through. This will protect the shaft. Crack the race the rest of the way with a hammer and chisel, using care to prevent personal injury from flying parts.

### CLEANING

Don't judge the condition of a bearing until after it has been cleaned.

Don't spin dirty bearings. Rotate them slowly while washing.

Don't spin any bearings with an air hose. Rotate one race by hand, when using air, to expose all parts of the bearing.

Bearings with a shield or seal on one side only should be washed, inspected and handled in the same manner as bearings without shields or seals.

Bearings with shields or seals on both sides should not be washed. Wipe them off to keep dirt from working inside. Smooth turning bearings may be coated with protective lubricant and then wrapped and stored or used in their original application.

If a small tank and wire baskets to soak and wash bearings are not available, a clean grease can or bucket filled with solvent may be used. Let the bearings soak long enough to loosen the grease and dirt. This may require several hours or longer. Then slosh the bearing around near the top of the container, giving it a turn now and then until it is clean. Rinse in a clean container of clean solvent.

A short, clean bristle brush from which the bristles will not come out or break off is a help in removing dirt, scale or chips.

After bearings have been thoroughly cleaned, inspect them immediately.

### INSPECTION

A little tarnish, stain or corrosion on the outside surfaces of the races is not detrimental to the operation of the bearing and need not be removed.

Bearings are inspected by holding the inner race so that its axis is vertical (bearing is then horizontal), and turning the outer race slowly.

Bearings should not be rejected because they feel slightly rough or have a tendency to stick at certain points when rotated by hand until the bearings have been re-cleaned. If bearings still feel rough and/or have a catch, inspect them closely to determine the cause.

The following defects are common causes of bearing rejection:

Broken or cracked races.

Dented seals or shields.

Cracked or broken separators.

Broken or cracked balls or rollers.

Flaked areas on balls, rollers or raceways.

Bearings that have been overheated. These bearings are generally darkened to brownish blue or blue-black color.

Bearings whose raceways are indented or "brinelled" by ball or roller impressions in the races.

(Continued on next page)

## RECOMMENDED BEARING PROCEDURES

### INSPECTION - Continued

An anti-friction bearing, properly lubricated, should not wear unless dirt or abrasive foreign matter gets into it. If dirt is allowed to enter a bearing it mixes with the grease or oil and forms a lapping compound that will quickly lap down the balls or rollers.

The load carrying surfaces of anti-friction bearings are finished with extreme care and will sustain very heavy loads unless the surfaces are damaged by abuse in handling or by foreign matter which may be abrasive or corrosive.

### BEARING INSTALLATION

Clean shafts and bearing housings thoroughly. Remove all dirt from keyways, splines and grooves. Remove burrs and slivers.

Clean and oil bearing seats.

Press bearings in straight and square.

Press only on the tight fitting race.

Press bearings until they are seated against the shaft or housing shoulder.

Bearing installation is just the reverse of bearing removal. Use an arbor press if available. Press the shaft into the bearing, supporting the inner race on blocks or a suitable press adapter to prevent bearing damage. Be sure the blocks or adapter does not scrape the shaft or threads.

If the distance between the end of the shaft and the bearing seat is fairly short, hold the shaft in a vise or suitable support and press the bearing onto the shaft with a clean tube. This may be done either in an arbor press or by tapping with a hammer. Cover the end of the tube with a suitable soft metal or hardwood blocks. This will allow the hammer blows to strike the tube dead-center and avoid cocking the bearing.

Do not leave bearings exposed in partial assemblies. Cover the bearings until ready to complete the assembly, to prevent damage by moisture, dirt or other foreign matter. Any clean cloth or paper will do as long as the bearings are well covered.

### HEATING BEARINGS FOR INSTALLATION

The inner bearing race, in some applications, may be shrunk on the shaft. This is a very simple operation consisting of heating the bearing in clean oil (Fig. I-2) or temperature controlled oven to a temperature of between 200° and 250°F. This expands the inner race sufficiently to allow it to slip over the shaft to the bearing seat. DO NOT OVERHEAT THE BEARING OR IT WILL LOSE ITS HARDNESS. Do not keep the bearing in the oil or oven after the correct temperature has been reached.

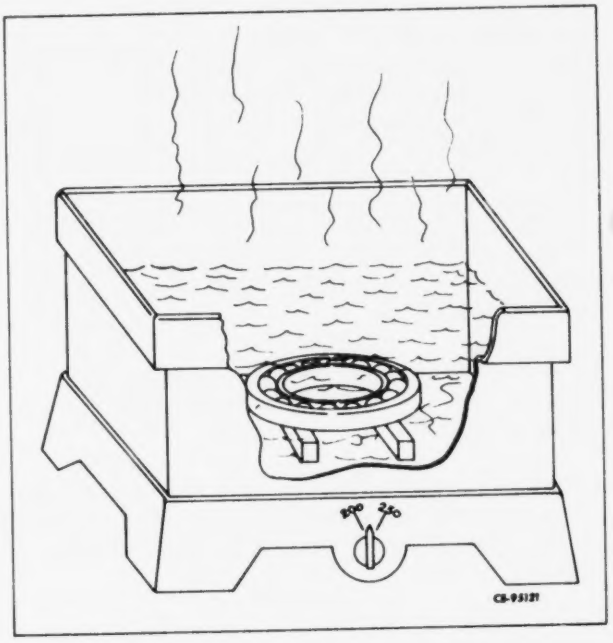

Figure I-2
Expanding Bearing in Heated Oil.

If expanding the race is not enough to get it on the shaft, freeze the shaft in dry ice for approximately 30 minutes. This will shrink the shaft and allow bearing installation.

### ADJUSTMENT

Certain types of ball bearings and most dual-purpose bearings with tapered or barrel shaped

## RECOMMENDED BEARING PROCEDURES

rollers require adjustment in assembly. Specific instructions covering bearing adjustment are contained in this manual where required.

If a bearing is set up too tight it will heat up and fail. Loose bearings will pound and fail or cause component parts to fail. Be sure to follow the bearing adjustment procedures carefully.

### LUBRICATION

Each assembly in this manual is supplied with a lubrication chart that specifies the kind of grease or oil to be used and how much. Operators Manuals specify the lubrication interval.

Follow instructions. Use only grease where grease is specified and oil where oil is specified. Be sure to use exactly the kind of lubricant the instructions call for.

Store grease in clean containers. Handle grease with clean paddles or grease guns. Keep grease containers covered.

Don't overfill. Grease or oil will ooze from overfilled housings past seals and closures, collect dirt and thereby lay the groundwork for bearing failure. Too much lubricant will also cause overheating. This is particularly true of bearings running at high speeds where the churning of the lubricant will cause the bearings to run excessively hot.

Don't let any machine stand idle for months without turning it over once in a while so that bearing surfaces will be covered with lubricant. Oil tends to drain down off a standing bearing. Moisture condensing in the housing is then free to corrode the un-coated bearing.

Be sure to inspect seals and vents regularly.

## LOCTITE AND LOCQUIC DATA

### LOCTITE

Loctite is a lock or seal for metal parts. It is furnished as a liquid plastic. Contact with air keeps it liquid. When confined between mating parts, the exclusion of air causes the liquid Loctite to set by chemical action.

### LOCQUIC

Locquic is a priming rinse used to speed the setting of the Loctite sealant and also must be used on zinc or cadmium plated parts for surface preparation to enable the Loctite sealant to completely set. Locquic Grade "Q" is available in six ounce pressure spray cans.

### LOCTITE RECOMMENDATION

Use Loctite Grade "B" (yellow color) on all threaded connections with the exception of the following:

1. Exhaust pipe mounting hardware.
2. Elastic stop nuts.
3. When lock washers are used.
4. When bolt or nut retaining lock plates are used.
5. On items requiring frequent service (500 hours or less), such as filler caps, adjusting screws, wheel stud clamp retaining nuts, etc.
6. On brass pipe plugs and fittings in air systems and all other pipe fittings.
7. All stud applications.

### PART PREPARATION FOR LOCTITE

PLAIN, PHOSPHATE COATED, OR PLATING OTHER THAN ZINC OR CADMIUM: Clean the surfaces where Loctite is to be applied to remove heavy coating of oil, grease and dirt (rust or light oil film are not detrimental). Normal shop practice of cleaning or degreasing is adequate. Allow surface to dry before applying Loctite. Care must be used on blind tapped holes to remove chips and oil.

(Continued on next page)

## LOCTITE AND LOCQUIC DATA

### PART PREPARATION FOR LOCTITE - Continued

ZINC OR CADMIUM PLATED PARTS OR FOR QUICK SETTING: To assure setting of Loctite on zinc or cadmium surfaces and quick setting on other surfaces at least one of the mating surfaces should be sprayed with Locquic Grade "Q." Locquic Grade "Q" is an effective rinse for oily parts. Allow surfaces to dry before applying Loctite Grade "B" sealant.

### LOCTITE APPLICATION

BOLT THREADS: Fill the first two or three leading threads in area of engagement with Loctite Grade "B."

PIPE THREADS: Use Loctite pipe sealant.

ALL STUD APPLICATIONS: Use Loctite plastic gasket.

#### SETTING

NORMAL TIME: Three to four hours.

WITH LOCQUIC GRADE "Q": Fifteen minutes.

#### REMOVAL

Parts difficult to remove can be pre-heated to approximately 500° prior to removal.

## GENERAL SAFETY PRECAUTIONS

A great deal of material contained in this service manual concerns itself with the removal and installation of exceptionally heavy items. During the time these operations are being carried out, safe working conditions and procedures are mandatory, not only to insure personal safety but the safety of others in the area. The following items are listed as a reminder of basic shop safety practices, too often neglected in day-to-day operation.

During service operations be sure safety bar is properly installed on tractor frame.

Hoists must be of sufficient capacity to lift the heavier units (i.e. engine, grille, fuel tank) and have an ample safety margin.

Floors must be clean and dry. After draining operations be sure all spillage is cleaned up. Electrical cords and wet floors make a dangerous combination.

Provide sturdy step ladders to mount and dismount from the engine compartment; do not climb on tires.

Be sure heavy items are properly supported from hoist or floor jack before removing supporting members from tractor.

Have sufficient service personnel available when removing or installing large heavy items in order to maintain control at all times.

If a heavy item begins to fall, let it fall; don't try to catch it.

Bucket and/or boom must be resting on ground at all times during machine servicing and periods of idleness.

Do not start an engine indoors unless adequate exhaust ventilators are provided. Once an engine is running, move the machine outdoors as soon as possible. Be sure air pressure is sufficient to provide positive brake application.

Keep hands, feet, clothing away from rotating engine parts.

As a machine is being moved, the operator must face the direction of travel.

Think before you act. Carelessness is one luxury the serviceman cannot afford.



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## SPECIFICATIONS

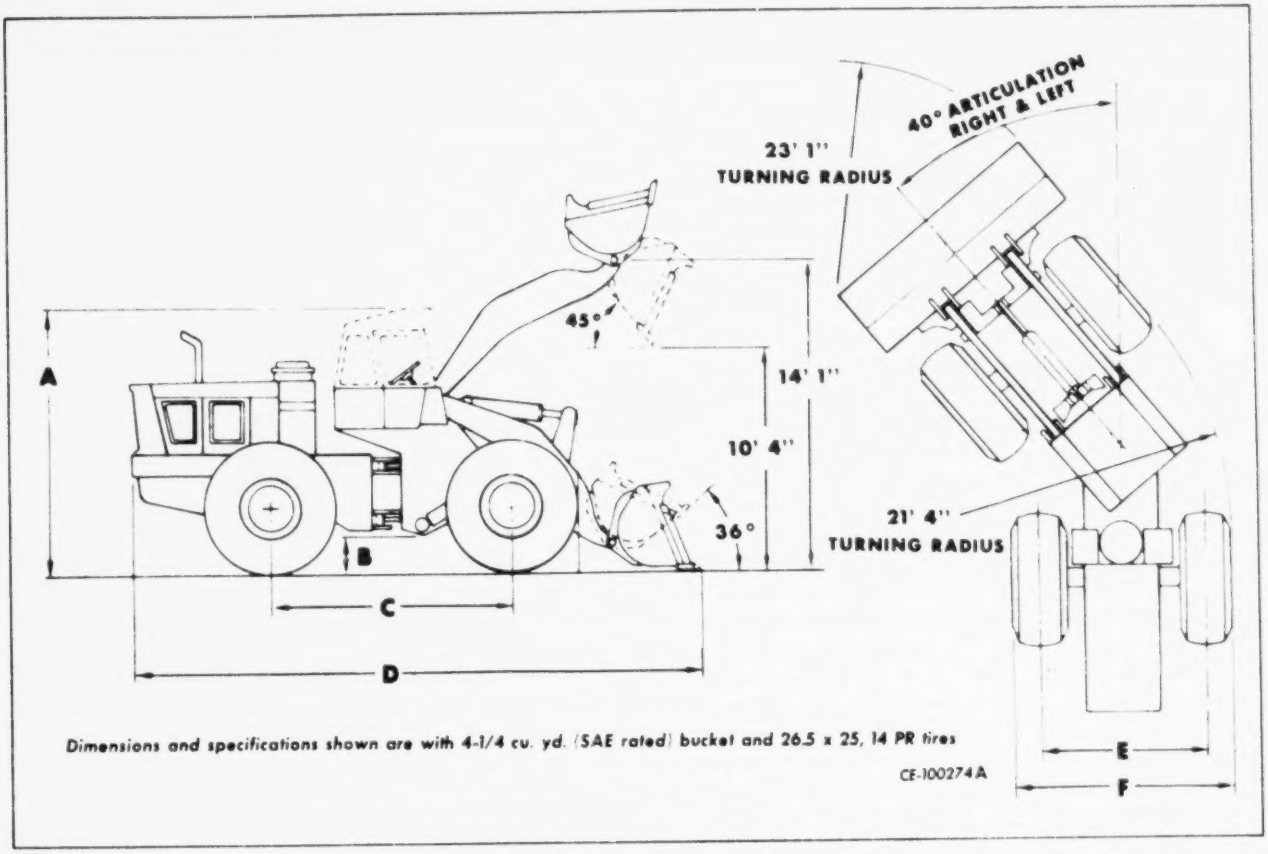


Figure I-3
Dimension Diagram.

## DIMENSIONS

| | |
|---|---|
| A. Height to top of cab | 12' 6" |
| B. Ground clearance | 23" |
| C. Wheel base | 11' 8" |
| D. Length with bucket on ground | 27' 4" |
| E. Wheel tread width | 8' 0" |
| F. Width at front and rear tires | 10' 4" |
| Total rear axle oscillation | 30° |

## WEIGHT

| | |
|---|---|
| Weight over front axle (Approx.) | 21,884 lb. |
| Weight over rear axle (Approx.) | 24,959 lb. |
| Total weight (Approx.) | 46,843 lb. |

## STANDARD TORQUE DATA

Recommended torques, in foot pounds, for standard application nuts or bolts shown below are applicable, provided:

A. All threads are lubricated with engine oil or chassis grease (refer to NOTE).

B. Joints are rigid; for example, no gaskets or compressible materials are used.

NOTE: Multiply standard assembly torques by the following factors:

1. .85 when metallic plated bolts or nuts are used.
2. .75 when parkerized bolts or nuts are used.
3. .70 when Molykote, white lead or similar mixtures are used as lubricants.
4. .90 when hardened surfaces are used under the nut or bolt head.
5. 1.20 when Loctite is used for plain bolts and nuts on the threads.
6. 1.25 when taper head bolts are used with bolt heads torqued.
7. 1.40 when Loctite is used for taper head bolts on the threads with bolt heads torqued.

When re-using bolts and nuts in service, use minimum torque values.

| BOLT SIZE | TYPE 5 | | TYPE 8 | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| 1/4 | 9 | 10 | 12 | 14 |
| 5/16 | 18 | 20 | 25 | 29 |
| 3/8 | 32 | 37 | 45 | 50 |
| 7/16 | 52 | 58 | 70 | 80 |
| 1/2 | 80 | 90 | 110 | 125 |
| 9/16 | 115 | 125 | 160 | 180 |
| 5/8 | 160 | 165 | 225 | 230 |
| 3/4 | 280 | 315 | 400 | 440 |
| 7/8 | 420 | 460 | 650 | 700 |
| 1 | 625 | 700 | 950 | 1050 |
| 1-1/8 | 840 | 950 | 1350 | 1500 |
| 1-1/4 | 1150 | 1300 | 1900 | 2100 |
| 1-3/8 | 1500 | 1700 | 2500 | 2800 |
| 1-1/2 | 2000 | 2300 | 3350 | 3500 |
| 1-3/4 | 3300 | 3700 | 5300 | 6000 |
| 2 | 5000 | 5500 | 8000 | 9000 |

## BOLT TYPE IDENTIFICATION CHART

| IH Type | Obsolete IH Type | SAE Grade | DESCRIPTION | BOLT HEAD MARKING |
|---|---|---|---|---|
| 5 | 2 | 5 | WILL HAVE 3 EQUALLY SPACED RADIAL LINES<br>Quenched and tempered medium carbon steel | |
| 8 | 4 | 8 | WILL HAVE 6 EQUALLY SPACED RADIAL LINES<br>Quenched and tempered medium carbon alloy or medium carbon boron steel | |



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## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

# LIKE IT OR NOT,

# YOU ARE INVOLVED -

## IN THIS BUSINESS CALLED SAFETY

There is no middle of the road when it comes to safety. You can't be neutral; you're in it over your head and like it or not, if you are not safety minded you're unsafe.

We as manufacturers have devoted a great deal of time and effort to provide as safe and efficient a machine as we know how. All this may be a wasted effort if you as an operator or serviceman refuse to read or heed warnings; fail to replace guards; climb on tires instead of ladders; use hoses instead of hand holds; operate too fast for conditions and fail to look where you are going.

The machine will not hurt itself; the questionable element is man. A safety conscious operator and a well cared for machine make a safe, efficient, profitable combination. With a "couldn't-care-less" type behind the wheel you have the ingredients of a disaster.

The options are clear but the question remains: "What type of operation will you provide?" and like it or not, you are going to have to come up with an answer.

# SECTION I

# CHASSIS

Page

SECTION I CHASSIS


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Description . . . . . 2
Service . . . . . 3
Adjustment . . . . . 4

Sheet Cowling . . . . . 8
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Boom and Bucket . . . . . 11
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## GENERAL INFORMATION

### DESCRIPTION

The chassis components are divided into four groups to simplify maintenance and to provide a better understanding of each group. The groups are as follows: Main Frame, Sheet Cowling, Operator's Compartment, Boom and Bucket.

The forward portion of the articulated frame provides a mount for the operator's compartment. Seated on the forward portion, the operator is always in line with the bucket allowing a greater degree of control and operating accuracy. The rear section of the main frame provides a platform to mount the engine, converter, transmission, grille and bulkhead.

In addition to their center hinge pins the frame sections are linked together by a pair of steering cylinders. The bases of the cylinders are anchored in the forward frame section with the rod ends pinned to the rear section. As one cylinder extends, the opposite contracts, pivoting the frame sections on the hinge pins and steering the tractor. This type of articulated steering has definite advantages; it eliminates the need of a steering axle with its additional parts, eliminates the drag link and tie rod and it allows the rear wheels to track in the path of the front wheels. This latter item insures a much shorter turning radius than that afforded by the more conventional rigid frame and steering axle type.

The front axle is fastened directly to the forward frame section. The rear axle is connected to a bolster which in turn is fastened by two pins to the rear frame section. This allows the rear axle to oscillate on uneven terrain.

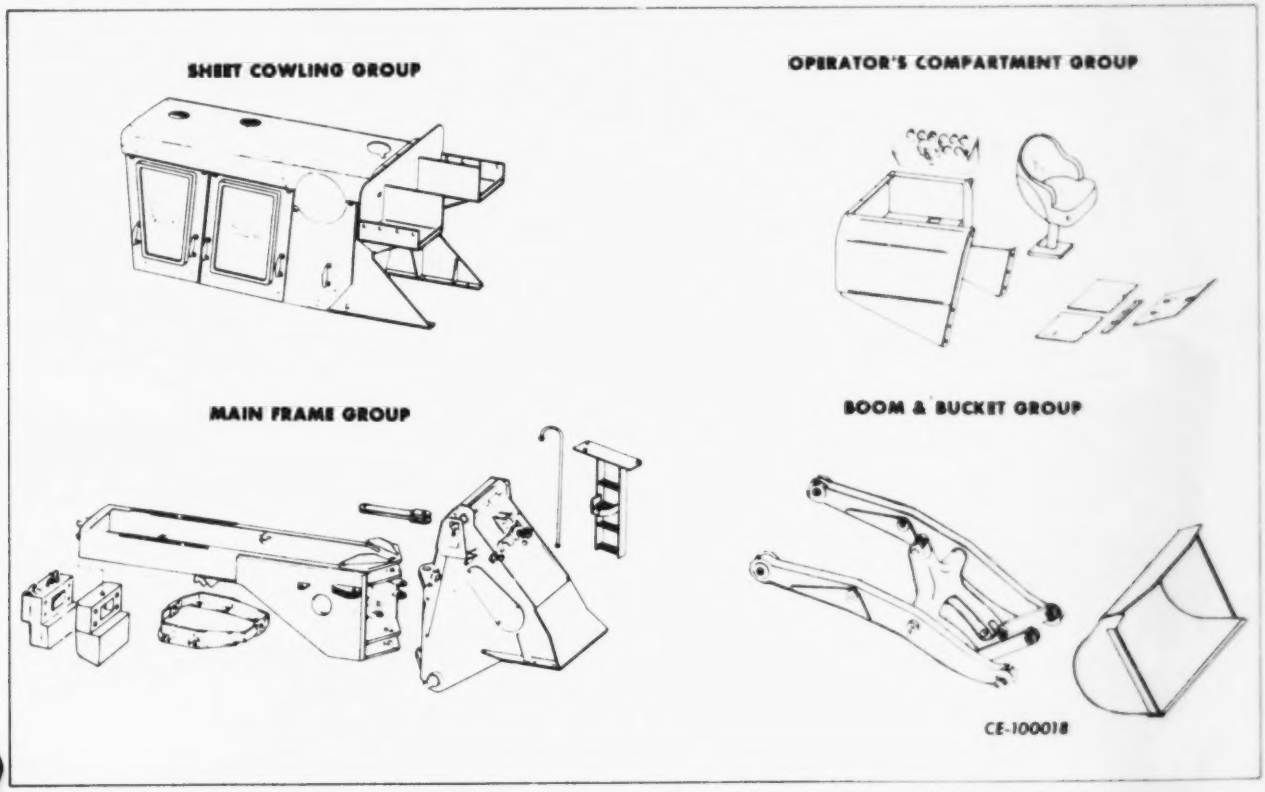


Figure 1-1
Chassis Components.

## MAIN FRAME

### DESCRIPTION

Each main frame component is composed of many smaller items welded together to form a single rigid assembly. Bushings are pressed into bores at pivot points and the counterweight is bolted to the rear of the rear frame section. The two frame sections are connected at their hinge points by a pin and bearing assembly. The rear axle bolster is connected to the rear main frame by pin and bushing arrangement.

The frame locking bar is pinned and locked to the side of the rear frame section in its rest position. The bar and pins are used to lock the two tractor halves when the tractor is serviced or transported.

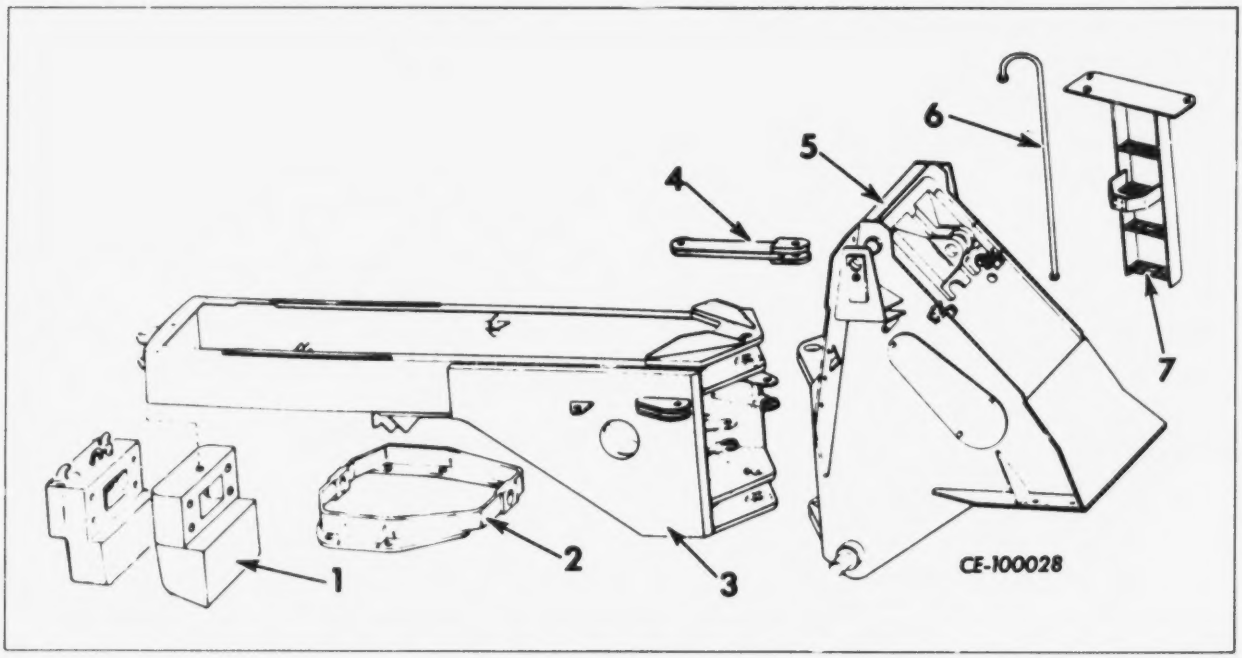


Figure 1-2
Main Frame Assembly.

1. Counterweight.
2. Bolster.
3. Main frame - rear section.
4. Frame locking bar.
5. Main frame - front section.
6. Hand rail.
7. Ladder.

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## MAIN FRAME

To lock the tractor halves in the straight position, the rear pin and cotter pin are removed, the bar swung forward and aligned with hole in forward section and pins replaced. (Fig. 1-3.)

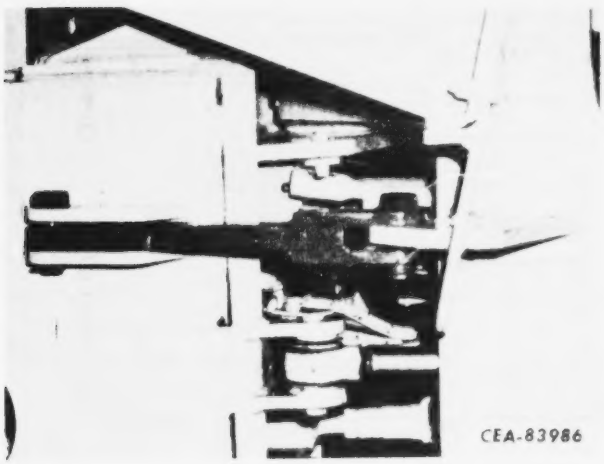


Figure 1-3
Safety Bar and Pin in Straight Lock Position.

To lock the tractor in either a full left of full right turn, only one pin is used. Position the tractor in its full turn position and insert pin in holes on closed side of tractor. Lock with cotter pin. (Fig. 1-4.)

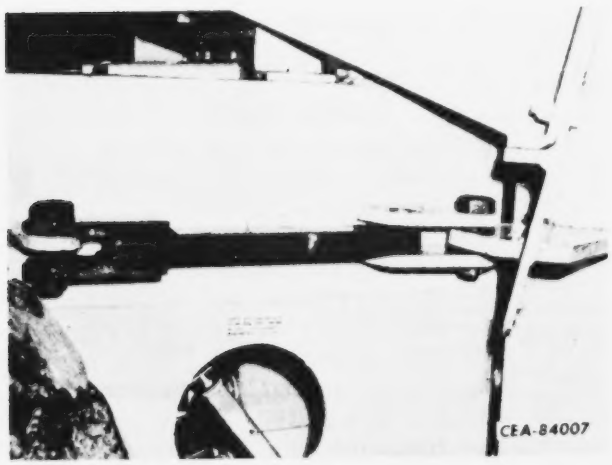


Figure 1-4
Pin Only in Full Turn Lock Position.

Be sure to install bar, pins and cotter pins in storage position when tractor operation is resumed. (Fig. 1-5.)

Replace any missing parts immediately to be sure the safety device is available for immediate use. Do not attempt to service or transport the tractor if the safety bar or pins are broken or missing.

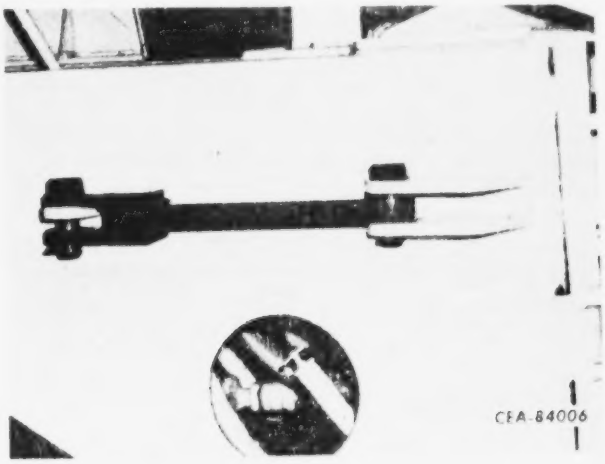


Figure 1-5
Safety Bar and Pins (Stowed Position).

## SERVICE

### INSPECTION

A periodic inspection of the chassis should be made to detect weld cracks, broken welds, or damaged brackets. Check bolster bushings and pins for wear or damage. Special attention should be given to the hinge pin assemblies being sure they are properly centered and seals and bushings are in good condition.

To keep rust and corrosion to a minimum, periodic painting of abrasions and bare metal is recommended.

### WELDING

Successful welding repairs require some knowledge of the materials being worked, use of the correct type and size of welding rod and preparation of material to be welded. The alloy

(Continued on next page)

## SERVICE - Continued

### WELDING - Continued

steels used in the construction of this tractor have a low carbon content but have been heat treated to obtain maximum strength, hardness, and wear resistance. To retain their strength, the steel members must nut be subjected to high residual temperatures.

To acquaint the serviceman with the technique required to produce successful repairs it is recommended that the manual entitled "WELDING MAINTENANCE," form SM-WELD-1 be obtained through your local INTERNATIONAL and HOUGH CONSTRUCTION EQUIPMENT dealer.

## ADJUSTMENT

### CENTER HINGE BUSHING

Place linkage in "FLOAT" position so that weight of bucket is on ground. If machine is without bucket, rest boom ends on blocks.

Adjust hinge spacing using top nut (3, Fig. 1-6) so that frame tongues (7, 18) are centered between rear frame ears (5, 16), such that "A" dimensions (Fig. 1-5A) are the same. "A" dimension may not be the same as "B" dimension. Bottom nut (20, Fig. 1-6) must be loose during spacing adjustment.

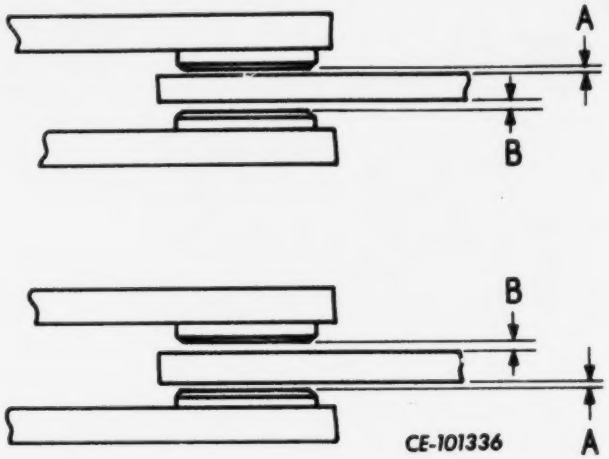


Figure 1-5A
Tongue Spacing.

If front frame tongues are too high, loosen top nut (3) until they are centered.

If front frame tongues are too low, tighten top nut (3) until they are centered.

Install retainer plate (4). Note that two retainer plate positions are available by turning the plate over.

(Continued on page 6)

Legend for Figure 1-6

UPPER HINGE PIN

1. Cap screw and lock washer.
2. Flat washer.
3. Hex nut.
4. Retainer plate.
5. Rear main frame ear.
6. Cord ring.
7. Front main frame tongue.
8. Cam.
9. Cap screw and lock washer.
10. Ball bushing.
11. Bushing.
12. Hinge pin.
13. Pin lock plate.

LOWER HINGE

14. Cap screw and lock washer.
15. Cam.
16. Rear main frame ear.
17. Cord ring.
18. Front main frame tongue.
19. Retainer plate.
20. Hex nut.
21. Flat washer.
22. Cap screw and lock washer.
23. Pin lock plate.
24. Hinge pin.
25. Bushing.
26. Ball bushing.
27. Sleeve.



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## MAIN FRAME

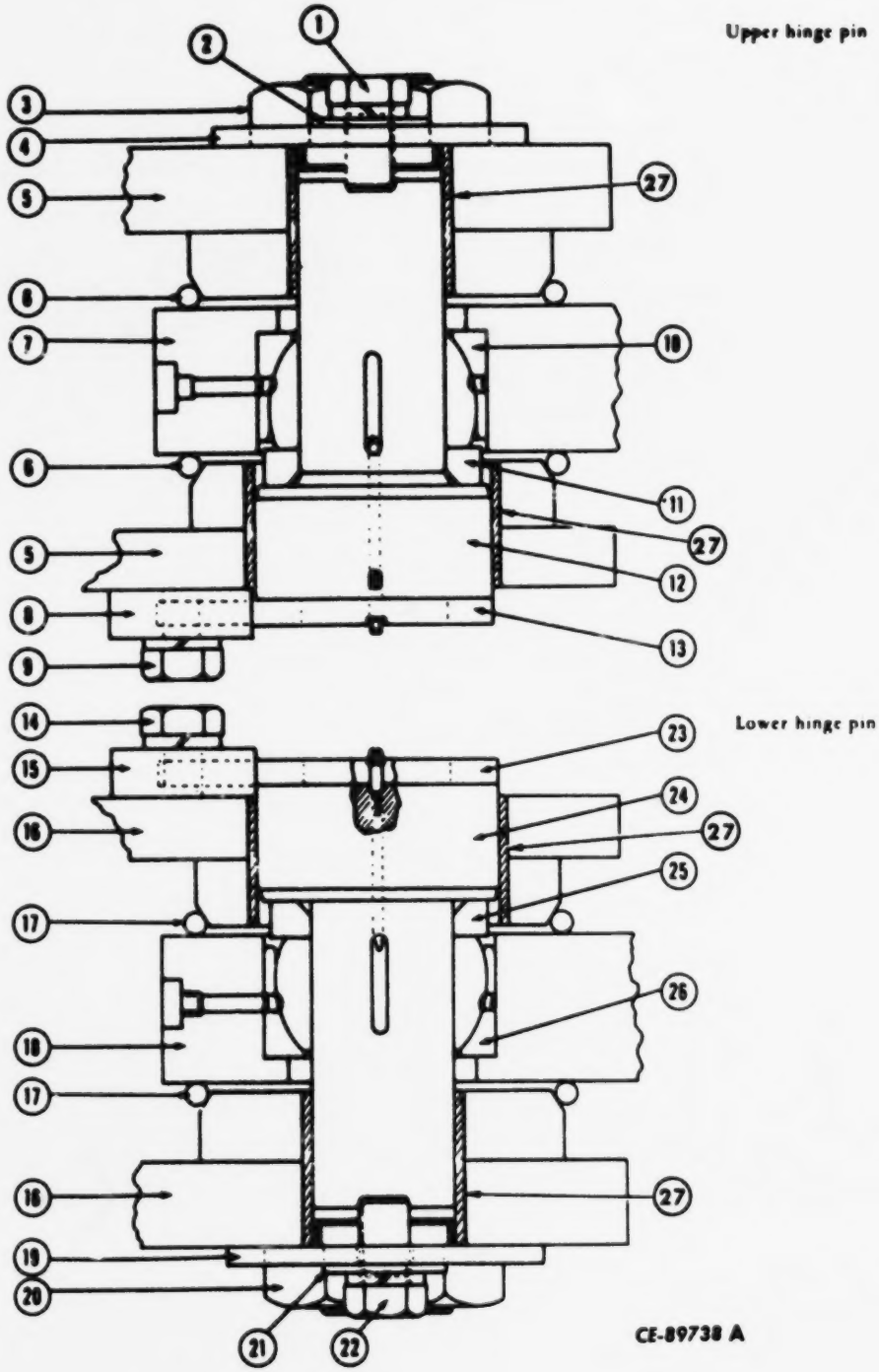


Figure 1-6
Center Hinge Bushing.

## ADJUSTMENT - Continued

CENTER HINGE BUSHING - Continued

Tighten bottom nut (20) with a one inch air impact wrench (225 to 250 ft. lbs.) to seat mating parts in hinge assembly.

Loosen bottom nut (20).

Tighten bottom nut (20) using retainer plate (19) as a wrench. Hinge should be just snug at this point - DO NOT OVER TIGHTEN.

If holes in retainer plate (19) line up with tapped holes in frame, install plate. Note that two positions are available by turning retainer plate over.

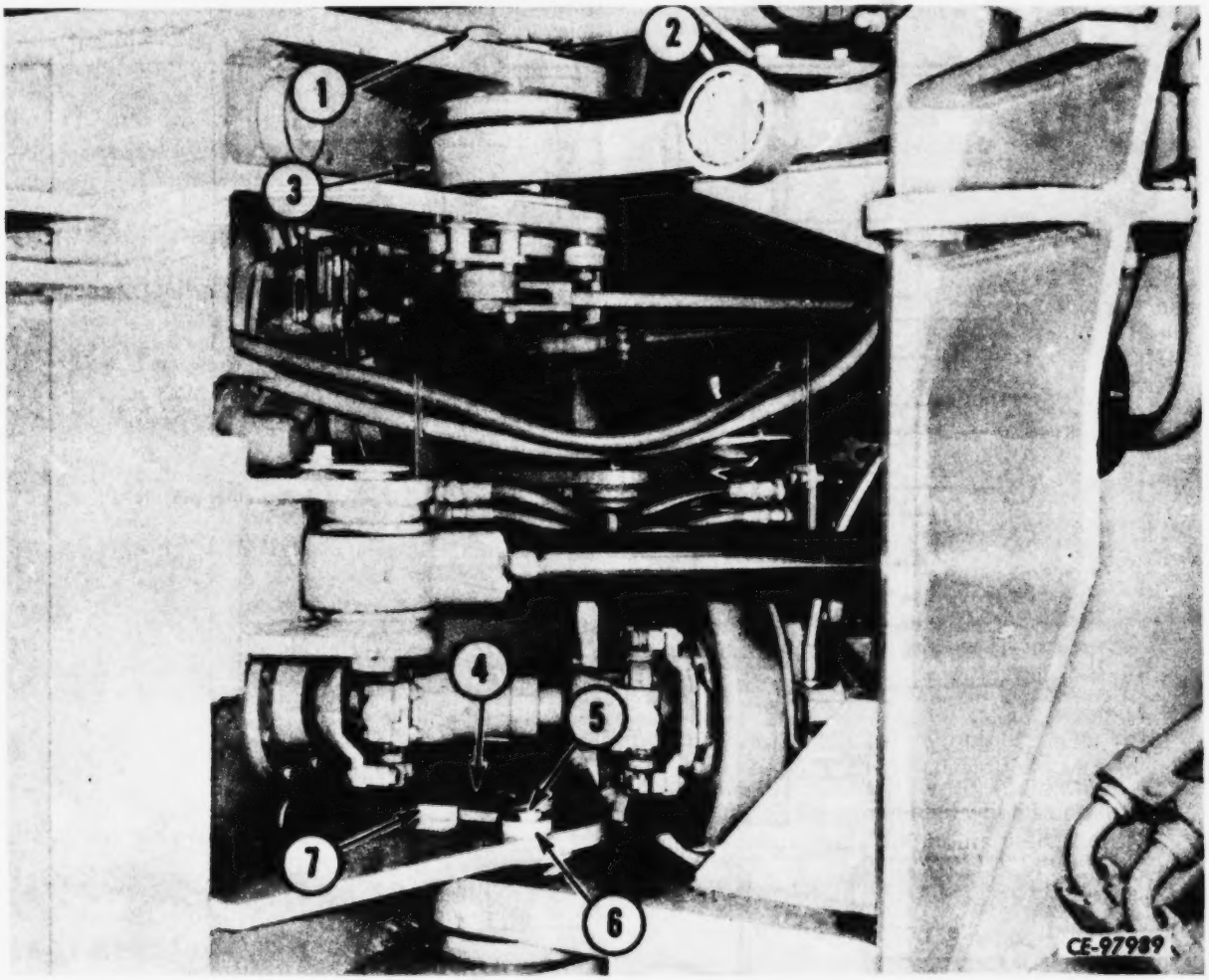


Figure 1-7
Center Hinge Details.

1. Retainer plate.
2. Cap screw and lock washer.
3. Lube fitting.
4. Pin lock plate (part of hinge pin weld assembly).
5. Cap screw and lock washer.
6. Cam.
7. Block.

## MAIN FRAME

If holes in retainer plate (19) do not line up with tapped holes in frame (in either retainer plate position), loosen nut (20) until plate holes line up with frame holes. Because two retainer plate positions are available, the amount of nut loosening required will always be less than 30°.

NOTE: Never loosen nut (20) more than 30°.

Install retainer plate (19).

Lubricate upper and lower hinge.

To adjust pin lock:

Bring pin lock plate (13, 23) into contact with block (7, Fig. 1-7).

Rotate cam (8, 15, Fig. 1-6) clockwise to contact pin lock plate (13, 23).

Tighten cam cap screw (9, 14).

Position a dial indicator with its base on front frame and indicator needle on rear frame. Start engine and power boom down until front tires clear the ground. Read and record indicator dial reading.

Raise boom to maximum height and again read and record indicator dial reading. Total vertical movement shown by dial indicator (difference between both readings) should not exceed .010".

If movement is excessive, repeat hinge adjustment procedure and re-check with dial indicator.

# CHASSIS

## SHEET COWLING

### DESCRIPTION

The sheet cowling, as in the case of the main frame, is made primarily by joining various weldments. The support (2, Fig. 1-8), assisted by the grille forms a backbone for the sheet cowling. The hood (1, Fig. 1-8) supported by the support (2) and grille provides the suspension member for the hood side panels (4 and 5). The battery boxes (3), both left and right, are weldments to the front support that bolts to the rear main frame weldment (3, Fig. 1-2). To these boxes the cover assemblies are added.

### SERVICE

Service of sheet cowling is limited. Bent components should be straightened and painted to prevent rust and corrosion.

Oil battery box cover hinges occasionally to prevent rusting.

Be sure engine side panel latches are lubricated occasionally with a few drops of oil. Latches must be kept in good working order. Replace damaged latches.

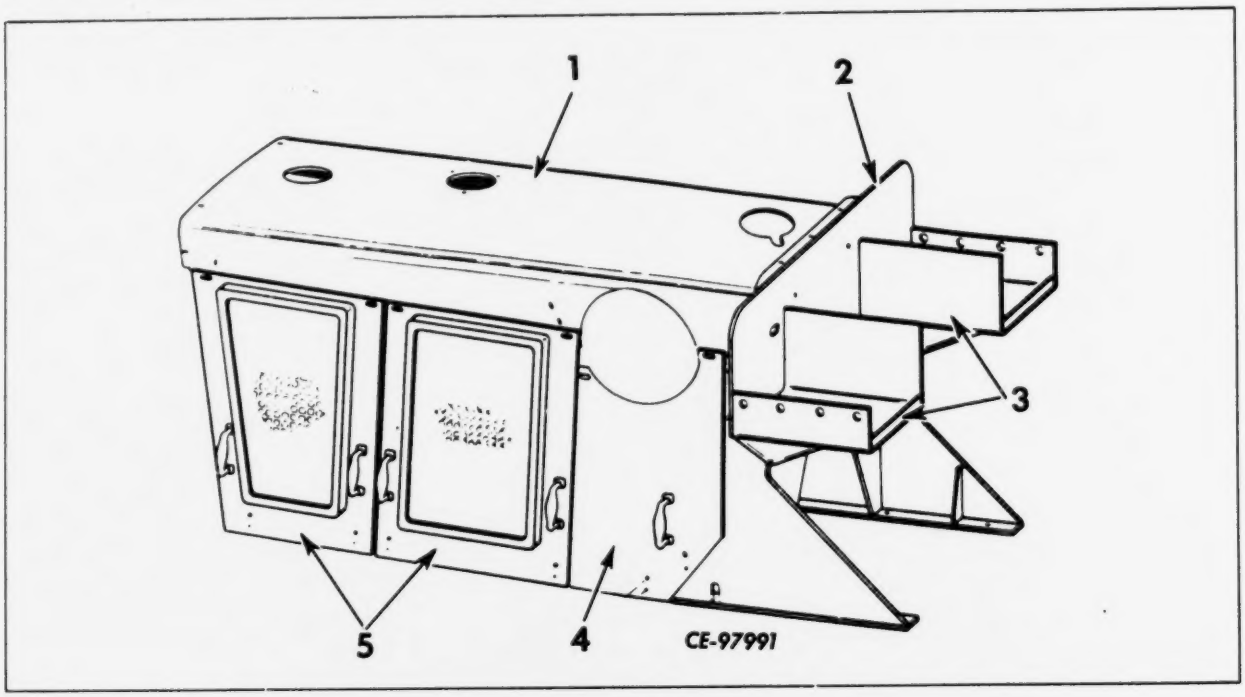


Figure 1-8
Sheet Cowling.

1. Hood.
2. Support.
3. Battery boxes.
4. Front side panel.
5. Center and rear side panels.

## OPERATOR'S COMPARTMENT

### DESCRIPTION

The operator's compartment is composed of the compartment enclosure, the instrument panel and box assembly, the operator's seat assembly and the compartment floorboards.

The compartment enclosure is bolted to the front main frame (3, Fig. 1-2) with the operator's seat assembly mounted on a raised platform at the rear of the enclosure. The seat height is controlled by the adjustable mounting bracket (3, Fig. 1-10).

Directional movement of the seat is controlled by a spring loaded ratchet device. A handle (1) to operate the locking mechanism is provided. A second locking device (2), allows the seat to be tipped forward during periods of inactivity. This protects the cushions from the heat of the sun and inclement weather.

The loader control levers are mounted to the upright portion of the elevated platform and to the right of the operator. Just forward of these control levers is the boom kick-out control. When included, the heater is mounted to the upright portion of the elevated platform and to the right of the operator.

The air horn control valve button is mounted on the floorboard beneath the transmission control levers, to the left of the operator.

The two brake pedals and accelerator pedal are mounted on the front floorboard and the transmission control cables, hand throttle linkage and steering gear shaft, pass through it.

(Continued on next page)

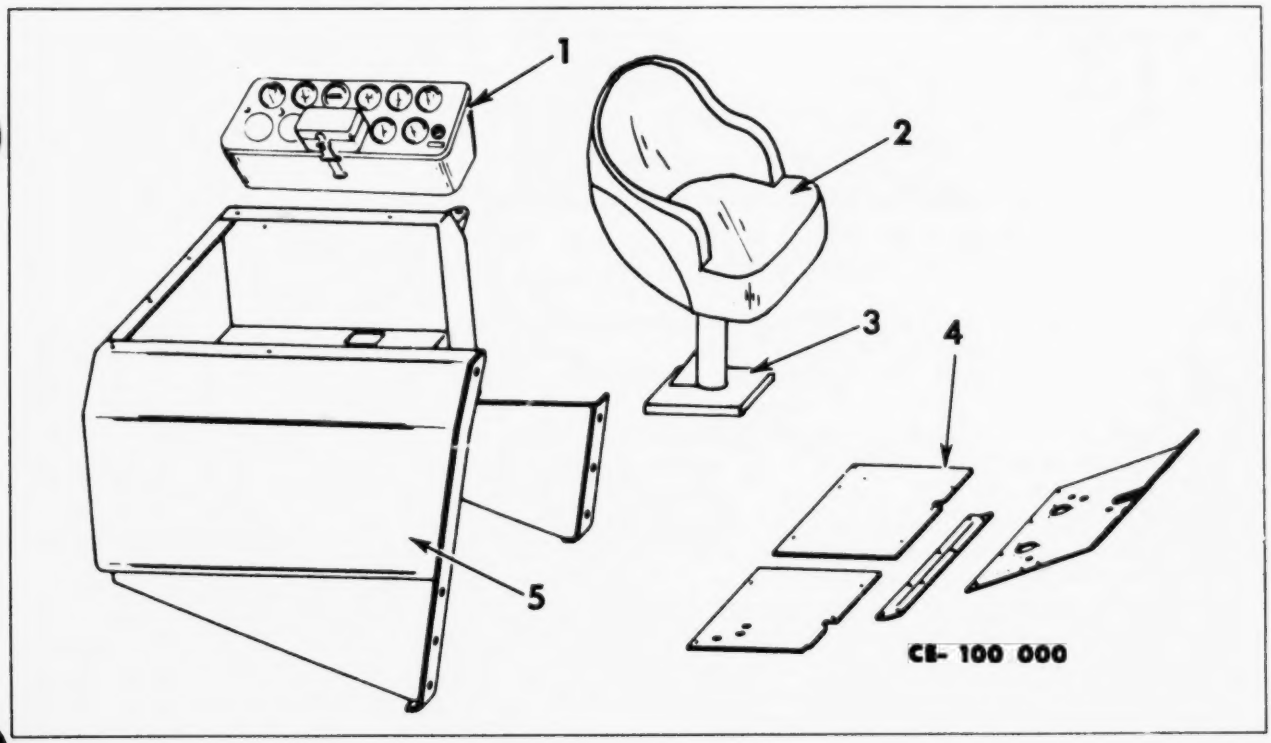


Figure 1-9
Operator's Compartment.

1. Instrument panel box assembly.
2. Operator's seat.
3. Seat mounting bracket.
4. Floorboards.
5. Compartment enclosure.

## OPERATOR'S COMPARTMENT

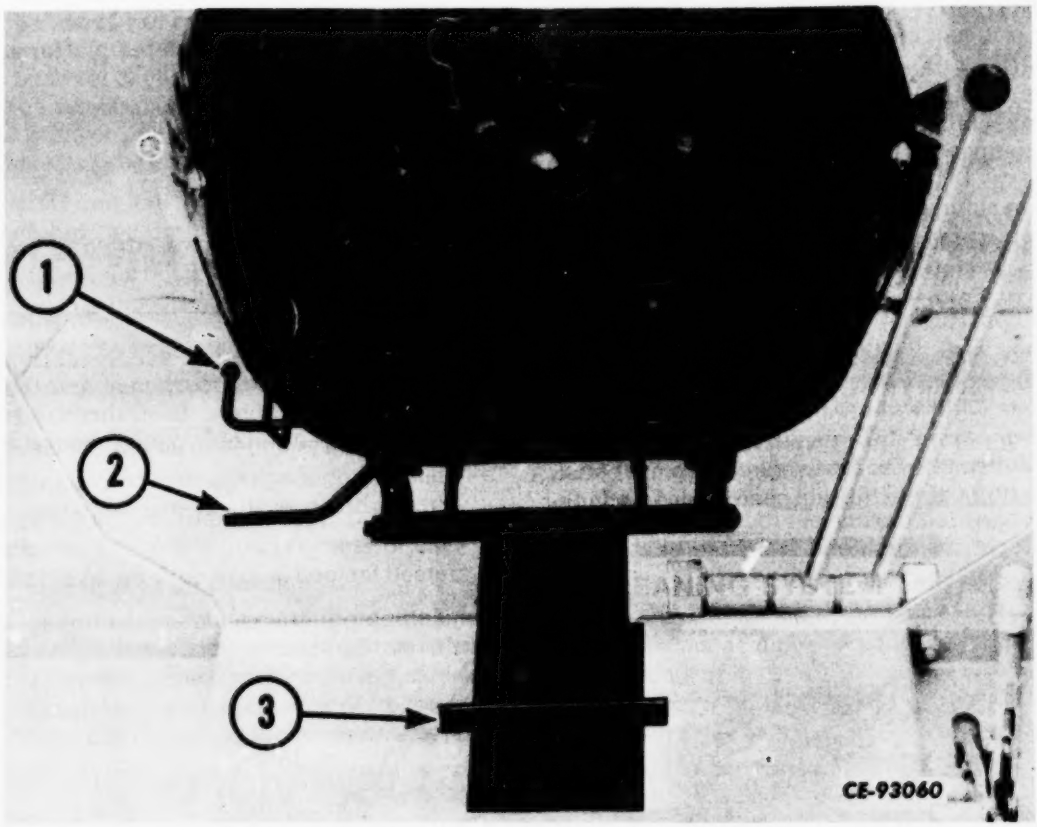


Figure 1-10
Seat Adjustment Mechanism.

1. Directional control release handle.
2. Tip-up latch.
3. Adjustable mounting bracket.

## DESCRIPTION - Continued

The instrument panel and box are mounted on the front main frame, to the left of the operator's seat. All wires leading to the instrument panel pass through a common connector at the base of the instrument box.

The hydraulic control valve is fastened beneath the platform floor in the right rear corner of the enclosure.

## SERVICE

Service on metal parts is limited to straightening dented or damaged sheet metal parts. Where fiberglass repairs are involved, a service manual entitled "FIBERGLASS MAINTENANCE," form SM-FG-1 is available through your local INTERNATIONAL and HOUGH CONSTRUCTION EQUIPMENT dealer.

A periodic lubrication of the seat locking mechanisms, control pivot points and the ignition lock cover hinge completes the service requirements of the operator's compartment.

## BOOM AND BUCKET

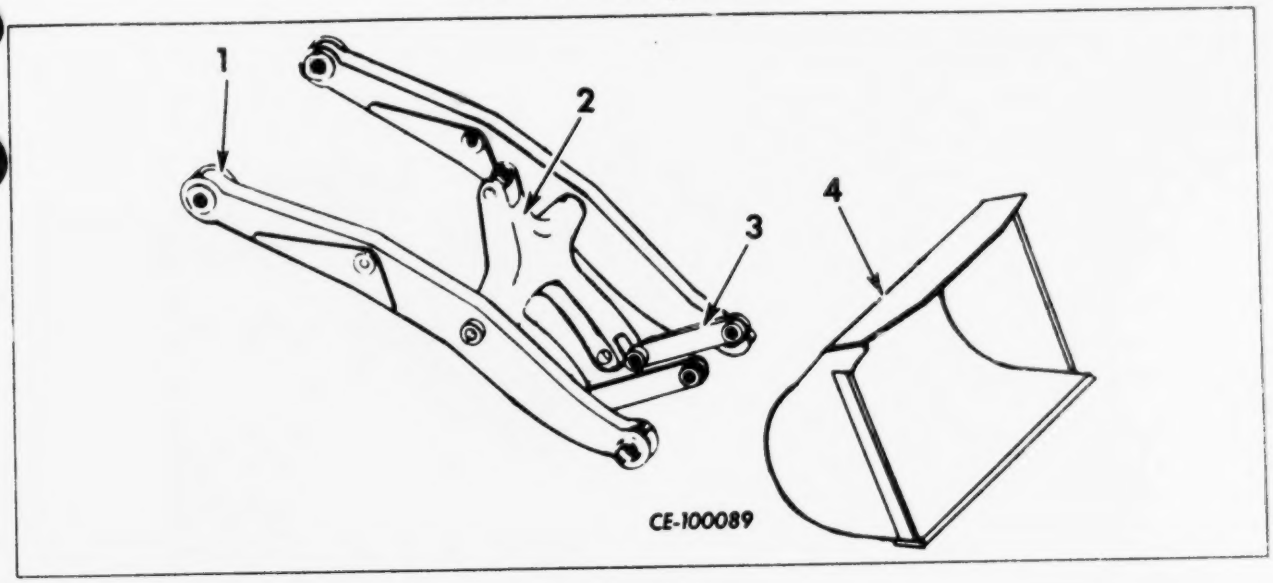


Figure 1-11
Boom and Bucket.

1. Boom.
2. Bellcrank.
3. Bucket link.
4. Bucket.

## DESCRIPTION

The loader linkage and bucket transform the energy produced by the tractor hydraulics into a visible working force. The hydraulic lift cylinders raise and lower the boom and the bucket cylinder actuates the bucket through the bellcrank and bucket link. The bucket may be moved from the fully retracted to the fully dumped position in a few seconds.

The boom (1, Fig. 1-11) is of welded steel construction. The bellcrank (2), joining the boom arms at its pivot point, is a one piece casting. The heavy bucket link transfers the stroke of the bucket cylinder rod, multiplied by the bellcrank, to the bucket. The bucket is heavily ribbed for added strength. Locking pins retain the bucket to the boom and dump link. The bucket is equipped with a replaceable, weld on, cutting edge.

The automatic boom kick-out control (Fig. 1-12) will automatically stop the boom at any preselected height. The control is air operated, its supply being taken from the right hand brake treadle valve. Pressurized air leaving the treadle valve (7) is piped to the control valve (4). The control valve responds to the movement of the cam follower and valve lever (3).

Adjustment is made by loosening the adjusting knob (5) and moving the cam plate (2) to the desired position and tightening the knob. The cam is actuated by the control rod (1) which moves with the boom. At one point in the cam's arc, the lobe on the cam (2) comes in contact with the lever (3). The movement of the lever forces the control valve (4) open. As the valve opens, the pressurized air from the treadle valve is allowed to pass through the valve and is directed to a piston at the rear of the boom plunger in the hydraulic control valve (6). The air pressure, acting against the surface of the piston, forces the piston down in its bore. In its downward movement the piston contacts and depresses the detent cam. Depressing the detent cam releases the detent balls and the plunger centering spring returns the boom plunger to the "HOLD" position.

## BOOM AND BUCKET

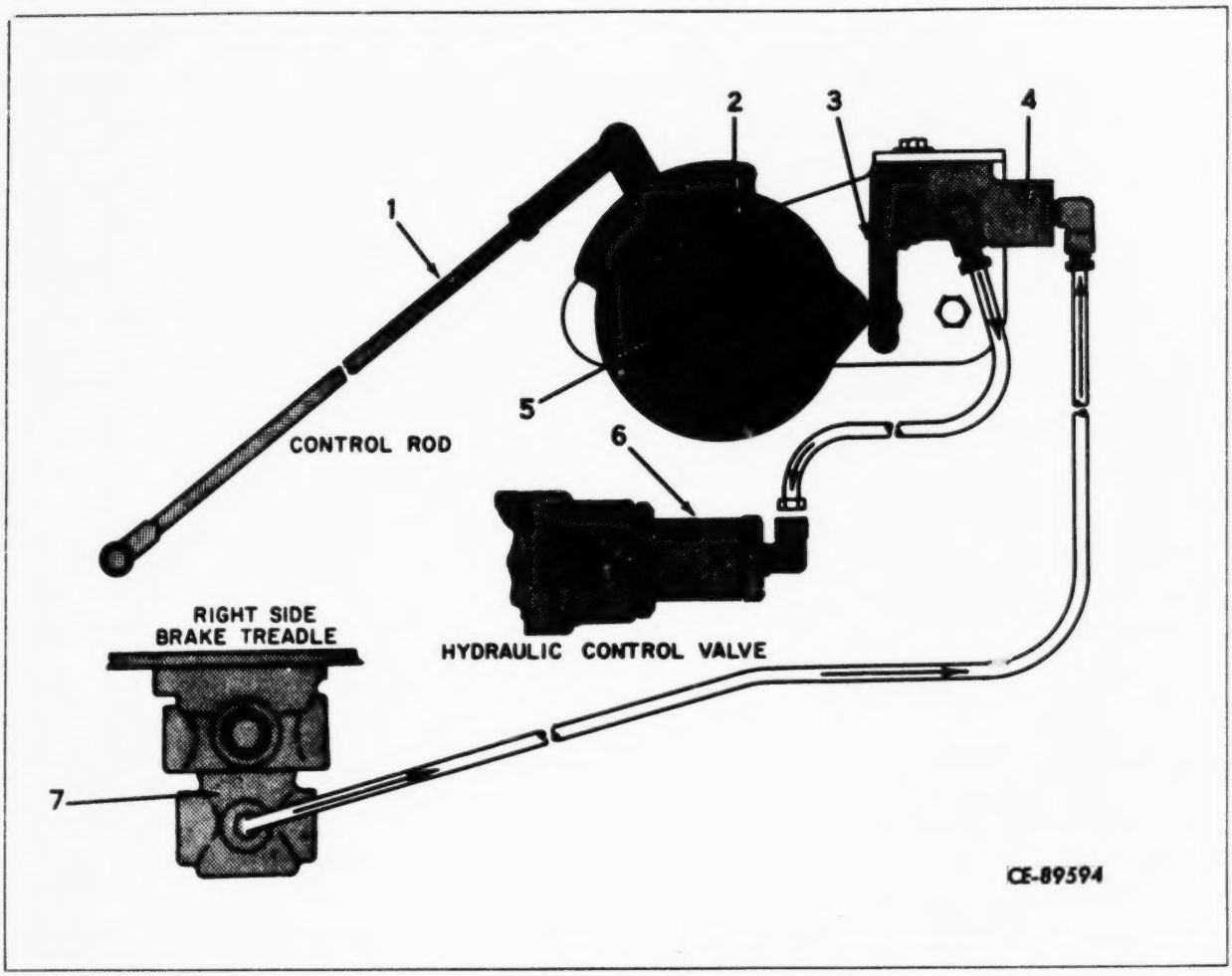


Figure 1-12
Boom Kick-out Control System.

1. Control rod.
2. Cam plate.
3. Air valve lever.
4. Air valve.
5. Adjusting knob.
6. Hydraulic control valve.
7. Right hand brake treadle.

## BOOM AND BUCKET

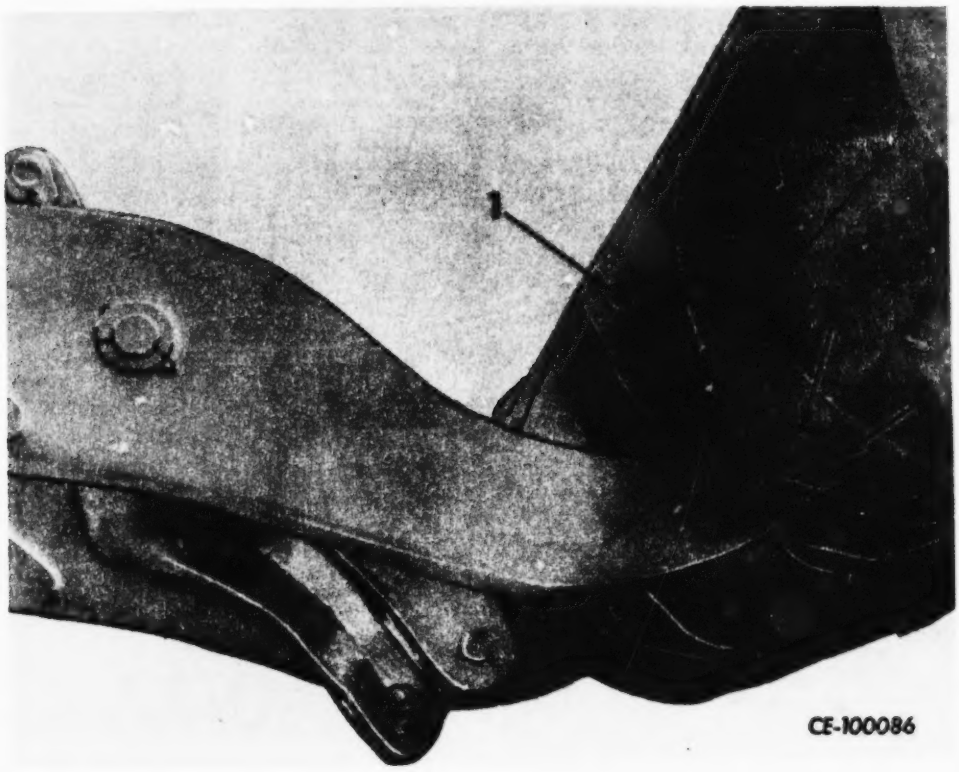


Figure 1-13
Typical Bucket Removal.

1. Pin assembly.
2. Cap screw.

## SERVICE

### BUCKET REMOVAL

Place bucket on ground, bottom sheet parallel to ground. Place loader controls in neutral ("HOLD") position. Securely block rear of bucket to prevent it from rolling back when bucket is separated from linkage assembly.

Remove the pin locking cap screws (2, Fig. 1-13) with lock washers and flat washers. Remove the pins (1) that attach the bucket links to the bucket.

◆ CAUTION: SUPPORT BUCKET LINKS DURING PIN REMOVAL. AFTER REMOVING PIN, CAREFULLY LOWER LINKS TO GROUND.

Retain cord rings.

Using a heavy gauge wire, wire the bucket links to the top of the bellcrank as shown in Fig. 1-14.

Remove cap screws (4, Fig. 1-13) with lock washers and flat washers. Remove pins (3) that secure the boom arms to the bucket. Place the boom control lever in "FLOAT" position allowing the boom arms to drop away from the bucket. Retain cord rings. Back tractor away from bucket.

NOTE: If available, support bucket with suitable chain hoist during removal operation.

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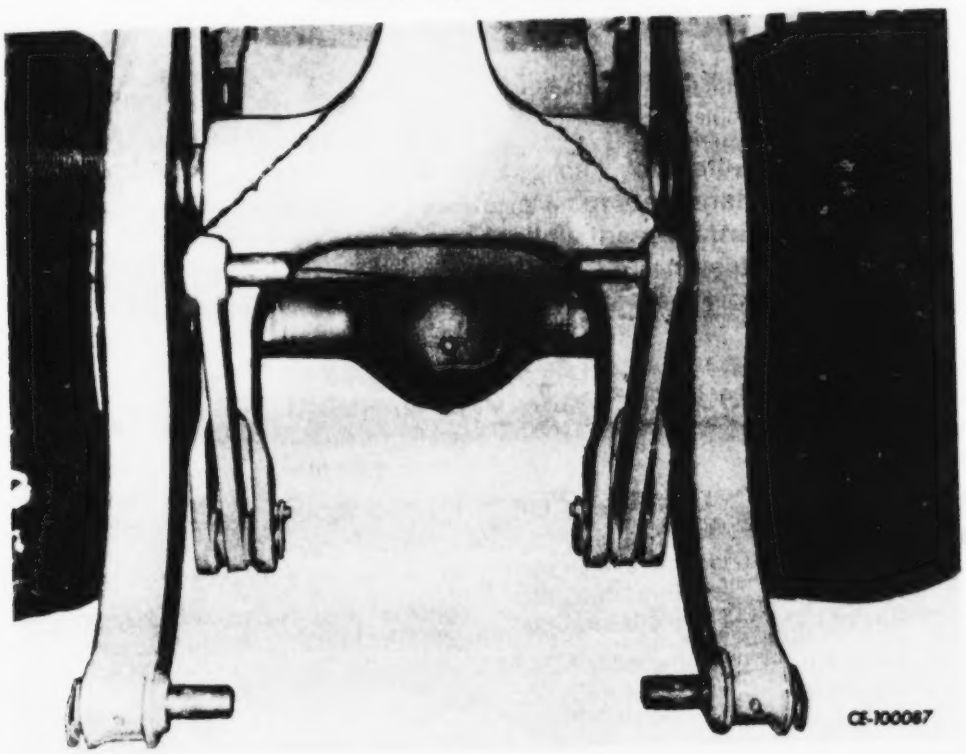


Figure 1-14
Bucket Link Wired Up.

## SERVICE - Continued

### BUCKET REMOVAL - Continued

As an alternate method, remove bucket link pins (1) as described above.

NOTE: If bucket is being removed to provide access to the tractor for servicing, the bucket links may be disconnected at the bellcrank.

Using a heavy gauge wire, wire the bucket links to the top of the bellcrank as shown in Fig. 1-14.

Start the engine. With the engine running slowly, raise the boom arms as the tractor is allowed to creep forward (Fig. 1-15). This will roll the bucket over allowing it to rest on the cutting edge and spillguard.

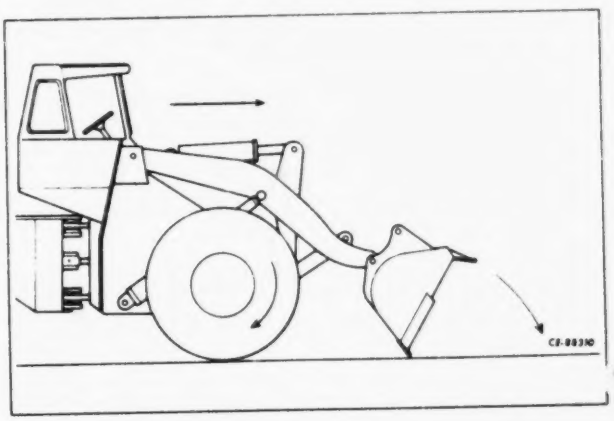

Figure 1-15
Rolling Bucket with Bucket Link Disconnected.

## BOOM AND BUCKET

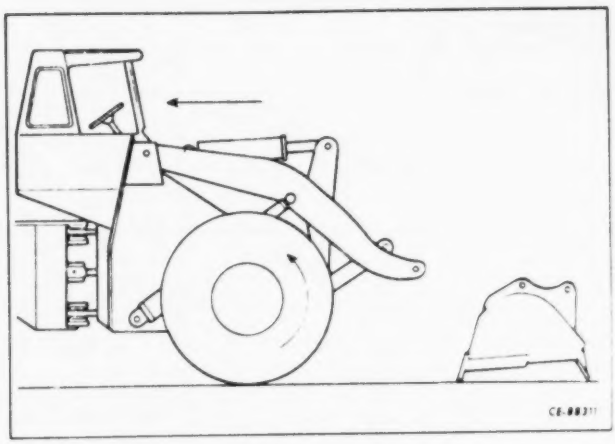

Figure 1-16
Backing Away from Bucket.

Place boom control lever in "HOLD" position. Remove boom pins (3, Fig. 1-13) and back tractor away from bucket.

To prevent loss of parts, install pins (1, 3, Fig. 1-13) in their respective bucket bores, looping cord rings over pins as they are installed. Thread locking cap screws (2, 4) with lock washer and flat washers through pinlock and into respective bores. Coat all pin shanks with a heavy, waterproof grease to prevent rusting.

To install bucket, reverse procedures described previously, being sure to install cord rings.

### CUTTING EDGE TIP REPLACEMENT

Replace the cutting edge tip before it wears back to the weld joining the tip and its backing plate. Use a carbon-graphite electrode to remove weld at rear of tip. Attach replacement tip to backing plate using a dry, low hydrogen E-7018 (AWS) electrode.

Replace tip as follows:

Prior to removing worn tip, straighten any bow that may be in cutting edge.

Tack weld a brace in the center of the bucket to hold straightened cutting edge (Fig. 1-17).

Clamp a stout piece of stock, having a straight edge, along the weld joining the tip and backing plate. Cut off front of tip at upper weld with cutting torch. Use clamped straight edge as guide for torch (Fig. 1-18).

Remove weld at rear of cutting edge tip and on bottom of backing plate (Fig. 1-19). Use air

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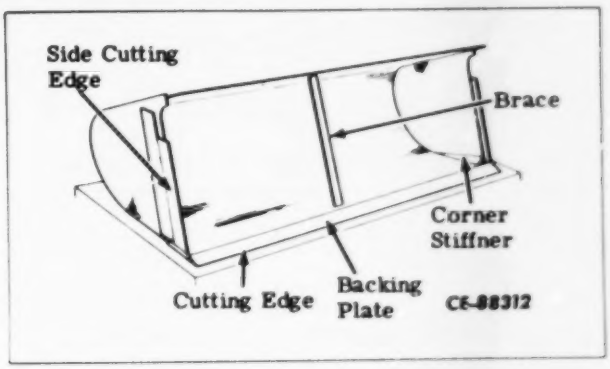


Figure 1-17

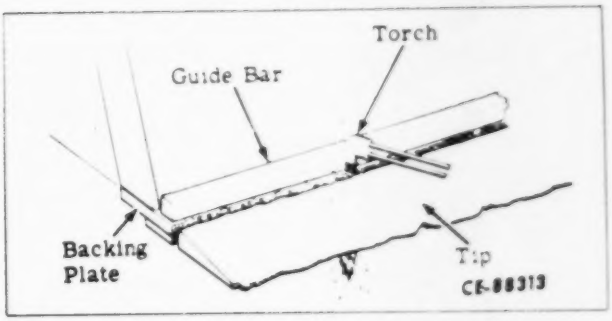


Figure 1-18

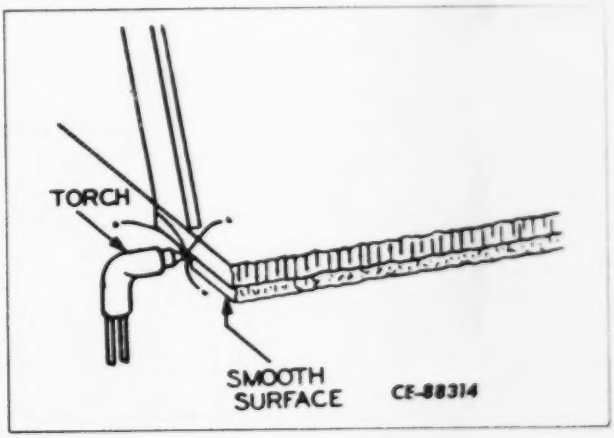


Figure 1-19

## SERVICE - Continued

### CUTTING EDGE TIP REPLACEMENT - Continued

carbon arc process. Keep heat penetration (heat build-up) in backing plate to a minimum to control plate warpage.

Dress backing plate along forward face and lower surface to receive replacement tip (Fig. 1-20).

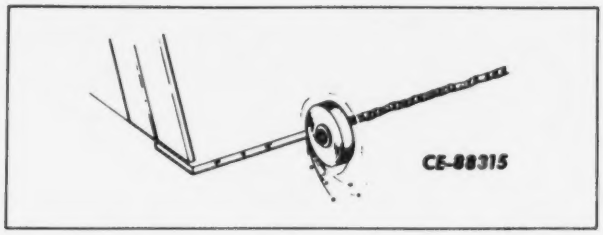


Figure 1-20

Position new cutting edge tip on backing plate. Tack weld tip to backing plate at front of plate and along back of tip (Fig. 1-21). Start tacks at center of tip and work alternately between front edge of plate and rear of tip toward both ends. Fix tip ends with firm welds.

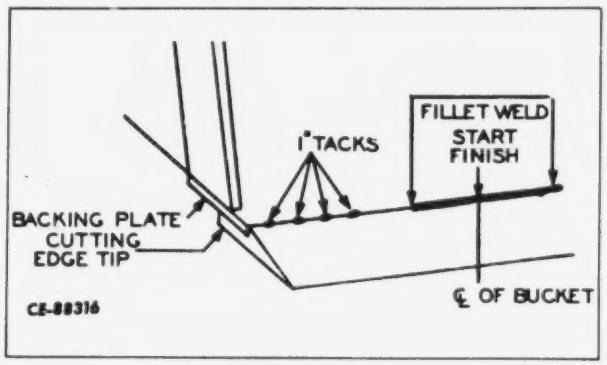


Figure 1-21

Best results will be obtained by preheating the tip and backing plate to 200°F. to 300°F. Use a 5/16" fillet weld to join the rear of tip to bottom of backing plate. Start a weld six inches on either side of tip center and work alternately toward the center. Skip six inches from previous welds and work back. Continue to backstep welds alternately on either side of tip center until weld is completed at bucket side plates. Join front tip to front of backing plate in same manner. Remove tack welded brace.

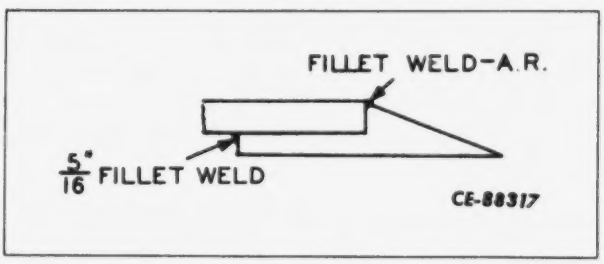


Figure 1-22

## SERVICE BULLETIN REFERENCE

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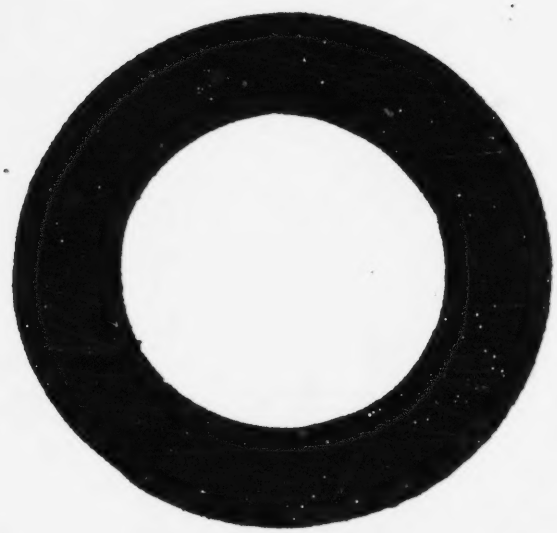

# SECTION II
# ENGINE

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SECTION II ENGINE


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## TRACTOR POWER UNIT

### GENERAL

Similar procedures are used in removing either the International Harvester or Cummins engine from the engine compartment. The exhaust stack, hood with air cleaner and grille with radiator and oil cooler must be removed in order to remove the engine and torque converter as a unit, from the tractor.

### REMOVAL

Position tractor under an overhead crane or portable hoist. Lower bucket to ground, apply parking brake and turn ignition switch to "OFF" position. If possible, steam clean engine and torque converter before removal.

Remove side panels from both sides of engine compartment. Remove clamps that secure exhaust stack to turbocharger exhaust elbow and remove stack. Loosen clamps at air cleaner hose connections and remove hoses from air cleaner. Air cleaner removal is not necessary.

Remove hardware securing hood to grille and front hood support and remove hood.

NOTE: On tractors equipped with Cummins engines, remove clamp and lid of by-pass filter (Fig. 2-1) to allow hood removal.

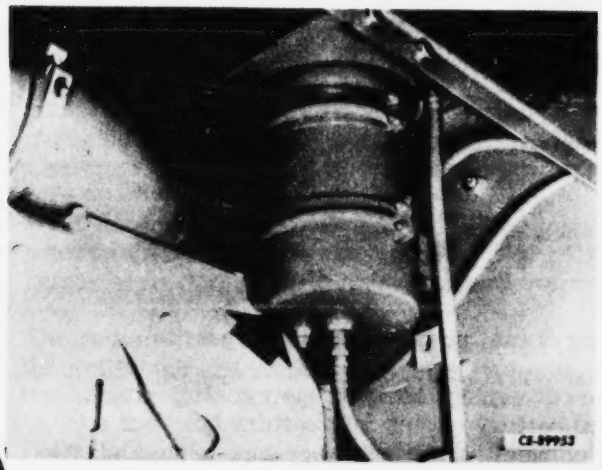

Figure 2-1
Cummins By-Pass Filter.

Disconnect and tag the electrical wires at rear lamps and stop lights.

Attach a flexible hose to radiator drain pet cock and drain radiator into a clean resealable container if coolant is to be reused. Remove radiator cap to allow the radiator to drain quickly. Reinstall cap after draining. Disconnect both upper and lower radiator hoses at radiator. Use a clean container and suitable drain hose to catch oil when connections at bottom of the oil cooler are tagged, broken and removed.

Remove hardware attaching radiator to lower mounting brackets. Do not remove mounting hardware from upper radiator brackets, as grille, radiator and oil cooler are removed as a unit.

Attach a suitable sling and hoist to grille and take up slack. Remove mounting bolts and nuts and lift grille slightly. Pull grille back far enough to clear the engine fan and lower complete assembly to the floor.

Disconnect battery cables, ground cable first, from batteries and pull cables through into engine compartment. Disconnect wiring looms at connecting plug in engine compartment.

Disconnect fuel tank-to-fuel pump line at pump. Disconnect air compressor lines from governor mounted on frame channel on left front side of engine compartment. (Fig. 2-2)

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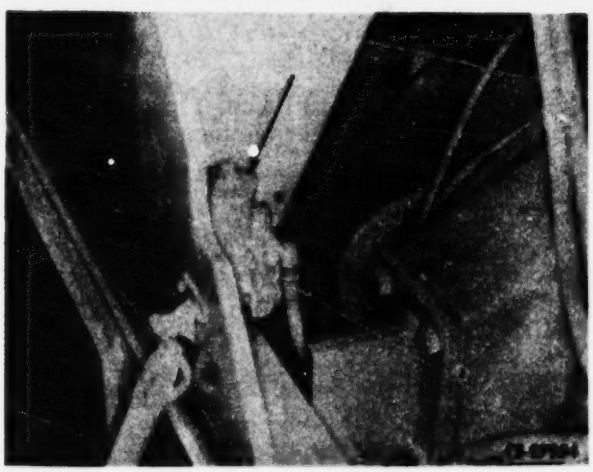

Figure 2-2

## TRACTOR POWER UNIT

### REMOVAL - Continued

Remove "U" bolt at front of fuel tank that secures oil drain hose of the International Harvester engine and tie drain hose to engine.

Disconnect fuel return line at fuel tank.

Disconnect accelerator link cable from injector actuating arm and pull cable through support bracket. (Refer to Section IX, "LINKAGE, ACCELERATOR").

Completely drain reservoir (refer to Section XI "HYDRAULIC SYSTEM, RESERVOIR"). Position a suitable size drip pan under torque converter area.

Remove clamps and disconnect reservoir-to-pump inlet line. Tag, disconnect and plug all reservoir, pump and hose lines to keep dirt from entering hydraulic system.

Tag, disconnect and plug or cap all lines at torque converter, main hydraulic pump and converter charging pump.

Disconnect and remove transmission-to-torque converter drive shaft.

Install a suitable sling in engine lifting eyes and attach to hoist.

Remove bolts and nuts that secure front and rear engine mounting brackets to frame.

CAUTION: Do not remove mounting brackets from engine.

Carefully lift engine out of tractor, checking for any wires, hoses or connections that may have been overlooked.

Set engine in a properly supported engine stand.

Refer to Service Manual, Form Number ISS-1519 for International Harvester Diesel engine overhaul.

Manuals for Cummins Diesel Engine may be obtained through your Cummins dealer.

### INSTALLATION

Steam clean engine compartment and check for wear or damage to wires, hoses or tubes. Repair or replace as necessary.

Using a suitable sling and hoist, raise engine from its stand and position it over engine compartment. Slowly lower engine into compartment, positioning engine mounting brackets onto support brackets on frame. Use a drift to line up mounting holes. Install mounting bolts and washers. Use new nuts on all mounting bolts. Refer to "SPECIAL TORQUES" when tightening bolts. Remove sling and hoist.

Position and install drive shaft.

Remove plugs and caps from hoses, tubes and converter and pump ports. Connect all tagged lines to their proper ports. Use new "O" rings. Be sure all split flange clamps are properly seated before tightening cap screws.

Connect all tagged lines to hydraulic reservoir. Be certain that all plugs and/or caps are removed before making connections. Check reservoir drain valve to be sure it is closed, and drain plugs in place and tightened.

Connect accelerator control cable (refer to Section IX, "LINKAGE, ACCELERATOR").

Untie engine oil drain of International Harvester engine and position it in place on front of fuel tank. Secure with "U" bolt and nuts.

Connect fuel return line to fuel tank, being certain the connection is tight.

Connect compressor outlet line to its mating section in frame channel. Connect compressor governor line to bottom of governor.

Connect fuel supply line to fuel pump.

Connect wiring looms at their mating plugs. Feed battery cables into battery box, but do not connect to battery.

With the aid of a hoist and suitable sling, raise grille-oil cooler-radiator unit into position on



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## TRACTOR POWER UNIT

tractor frame. Work carefully to avoid damage to fan blades or radiator fan housing. Install grille mounting bolts, washers and nuts. Tighten securely before removing sling and hoist.

Install lower radiator mounting cap screws into brackets and tighten nuts.

Connect previously tagged lines to oil cooler. Connect both upper and lower radiator hoses to radiator.

Connect wire ends previously tagged, to rear lamps and stop lights.

With a suitable sling and hoist, raise and install hood on grille and front bulkhead. Line up mounting holes and install cap screws, washers and nuts. Remove sling and hoist.

Install short hose between air cleaner and engine air inlet pipe. Tighten hose clamps securely.

Connect air compressor air inlet hose to air cleaner.

Install exhaust stack, through hood, on exhaust of turbocharger. Tighten stack clamp securely. Fill radiator with clean, fresh coolant. Fill hydraulic reservoir with fresh, filtered fluid. Refer to Section XI, "HYDRAULIC SYSTEM" for recommended lubricant and capacity. Check the engine crankcase oil level and add oil as required.

On Cummins engine installations, replace lid of by-pass filter and clamp securely. (Fig. 2-1)

Connect cables to batteries, ground cable last. Make a final check to determine that no connections or mounting hardware have been missed.

Start engine and check for leaks at radiator and torque converter connections.

With engine idling, check transmission fluid level. Add fluid as needed.

Replace side panels.

## RADIATOR AND OIL COOLER

### GENERAL

The same procedure is used to remove the radiator and oil cooler from the engine compartments of the International Harvester and Cummins engines.

With the hood properly supported and disconnected from the grille, the grille can be removed from the tractor frame.

The radiator and oil cooler are connected to the grille and are removed as a unit from the tractor frame.

Lock the tractor in a "straight lock" position with safety bar. Lower bucket to ground.

Apply the parking brake and turn the ignition switch to "OFF."

### REMOVAL

Remove side panels.

If the coolant is to be reused, drain the radiator into a clean, resealable container using a flexible hose. Remove radiator cap while draining. Replace radiator cap and close drain cock after draining. Place a suitable drain pan under the oil cooler and disconect hoses at bottom of oil cooler. Tag each hose and plug them to keep dirt out of the system.

Loosen radiator hose clamps and disconnect hoses.

Tag and disconnect electrical wires from the rear driving lights and stop lights.

(Continued on next page)

## RADIATOR AND OIL COOLER

### REMOVAL - Continued

Disconnect hood from grille by removing retaining cap screws, flat washers and nuts. Block up hood with suitable supports while grille is removed.

Attach a suitable sling and hoist to grille and take up slack. Remove cap screws, flat washers and nuts from lower radiator mounting brackets. Remove grille mounting hardware.

Raise grille slightly and pull it back until fan housing clears fan blades. Remove grille and lower it to floor. Remove radiator and oil cooler from grille by removing hardware from upper radiator mounting brackets.

### INSTALLATION

Position oil cooler and radiator on grille and install and tighten mounting hardware at the upper radiator mounting brackets.

Attach a suitable sling and hoist to the grille and raise the entire unit into position. Carefully work the unit forward into its proper mounting position, with the radiator fan shroud around the fan blade. Install the grille mounting bolts, flat washers and nuts. Slacken sling and hoist. Line up lower radiator mounting brackets with frame brackets and install cap screws, flat washers and nuts. Tighten all grille mounting hardware and remove sling and hoist.

Reconnect previously tagged wires to rear driving lights and stop lights.

Connect cooler hoses to oil cooler after removing plugs.

Connect upper and lower radiator hoses and secure with clamps.

Remove hood supports and install retaining cap screws, flat washers and nuts. Tighten securely.

Be sure radiator drain cock is closed. Remove radiator cap and fill system with clean, fresh coolant. Replace radiator cap.

Start engine and check for leaks. With engine idling, check transmission and radiator fluid levels. Add fluid as required. Install side panels.

## AIR CLEANER - SINGLE ELEMENT

### GENERAL

The filter element, body and unloading valve should be serviced at regular intervals. The hoses and connections should also be checked for leakage and wear. Dirty air entering the system without first passing through the air cleaner can cause serious damage to the engine.

For maintenance interval on air cleaner system, refer to Operator's Manual, Form OM-H-100C.

### REMOVAL

Remove right forward side panel.

Loosen air cleaner-to-engine hose clamps and remove hose.

Remove cap screws and nuts that hold cleaner mounting clamps to mounting brackets and remove clamps and air cleaner.

Remove clamp assembly that holds cover to the cleaner body and remove the cover.

Unscrew wing bolt from center of filter element seal washer and remove bolt and seal washer. Pull the filter element from body.

### FILTER ELEMENT SERVICE

Inspect filter element for leaks or damage by placing a bright light inside the element. Inspection of element on the outside will disclose any holes where concentrated light shines through. The slightest rupture requires replacement of filter element.

The element can be cleaned by either of two methods; washing or compressed air.

Washing is the preferred method as it removes more dust and soot than cleaning with compressed air. Washing results in better performance and longer intervals between required



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## AIR CLEANER - SINGLE ELEMENT

element service. It is suggested that spare elements be available for use while the serviced element is drying. This will reduce unit downtime to only a few minutes and will allow sufficient time to properly service the restricted element.

NOTE: A filter element must be replaced after six washings.

Cleaning the element with compressed air is not considered an entirely satisfactory method. Some dust will remain in the element, requiring more frequent servicing. This method is to be used only as a temporary measure until sufficient time is available to clean the element by washing.

NOTE: After cleaning, if an element is to be stored for later use, place it in a plastic bag and store in an element shipping container to protect against dirt and damage.

### WASHING

NOTE: Never wash elements in fuel oil, gas or solvent. DO NOT OIL ELEMENTS. Do not attempt to take elements apart. Do not tap the element against a hard surface; this will damage the element.

1. Tap side or end of element against the palm of your hand to remove loose dust.

2. Wash element in clean, warm water (+70°F to +100°F). A small amount of non-sudsing detergent added to water will facilitate removal of soot.

3. Rinse element in clear water (if a hose is used, do not exceed 40 psi). Shake element carefully to remove excess water.

NOTE: Do not use compressed air to speed drying of element; the air pressure will rupture the wet element.

4. Lay element on its side and allow it to air dry before re-installing. Overnight drying is usually sufficient. When drying element protect it from dirt and/or freezing.

NOTE: If no spare element is available, the wet element, after excess water has been shaken out, may be installed in air cleaner and engine operated at low idle for 10 minutes before operating tractor.

### COMPRESSED AIR

NOTE: Do not tap element against a hard surface; this will damage element.

1. Carefully tap side or end of element against the palm of your hand to remove loose dust.

2. Direct clean, dry compressed air up and down the pleats on the "clean side" of element Always direct compressed air opposite the normal operating air flow through element.

NOTE: Air pressure at nozzle must not exceed 100 psi. Keep a reasonable distance between air nozzle and element.

### UNLOADING VALVE AND AIR CLEANER BODY

Squeeze rubber lips of unloading valve to remove any residual dust or dirt and to be certain that valve is not blocked or inoperative.

Wipe inside of air cleaner body with a clean, damp cloth. A small amount of non-sudsing detergent added to water will facilitate soot removal.

## INSTALLATION

Position mounting clamps on air cleaner body and attach clamps to mounting brackets by installing mounting hardware. Position cleaner body so that the unloading valve is correctly positioned. Install hose and hose clamps, then tighten mounting clamp cap screws.

Install a new or cleaned filter element in filter body and secure in place with seal washer and wing bolt. Install cover and cover clamp and tighten securely.

# ENGINE

## AIR CLEANER-DUAL ELEMENT

### REMOVAL

Remove right forward side panel.

Loosen clamp securing air inlet hood and tube assembly to air cleaner body and remove hood and tube.

Loosen air cleaner to engine hose clamps and remove hose.

Remove cap screws and lock washers that secure cleaner mounting clamps to tractor and remove clamps and air cleaner.

### DISASSEMBLY

Loosen clamp (1, Fig. 2-3) or wing nut (1, Fig. 2-4) and remove cover (2).

Unscrew wing bolt (3) from center of filter element and remove bolt, seal washer (4) and primary element (5).

Remove stop nut (6) and washer (7). Remove safety element (8).

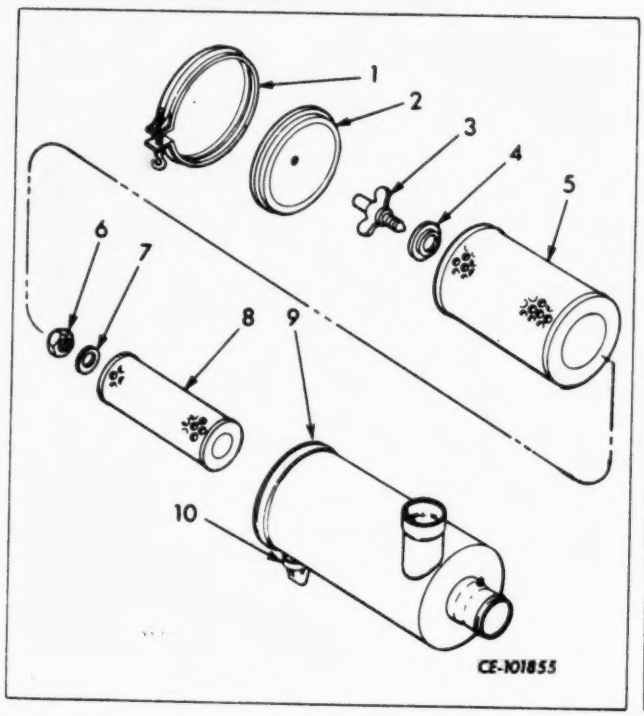


Figure 2-3

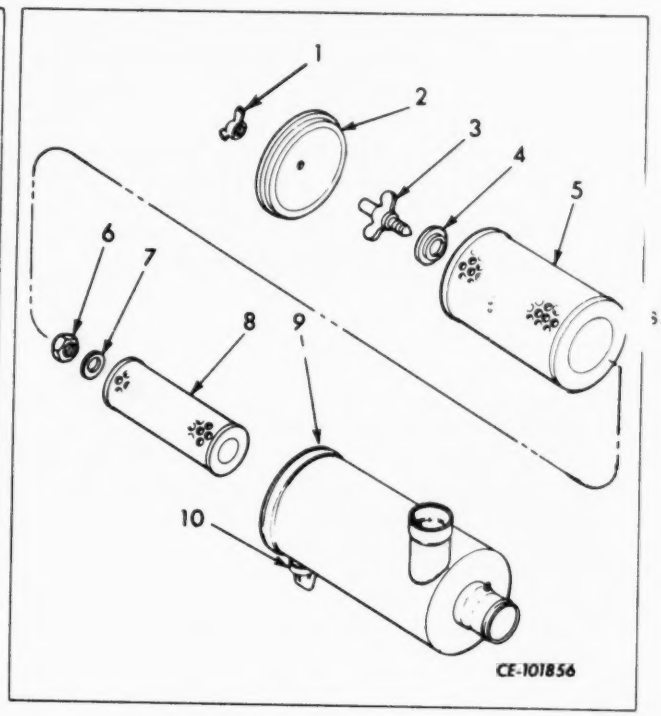


Figure 2-4

Dual Element Air Cleaners.

1. Clamp.
2. Cover.
3. Wing bolt.
4. Seal washer.
5. Primary element.
6. Stop nut.
7. Washer.
8. Safety element.
9. Air cleaner body.
10. Unloader.

1. Wing nut (part of cover assy).
2. Cover.
3. Wing bolt.
4. Seal washer.
5. Primary element.
6. Stop nut.
7. Seal washer.
8. Safety element.
9. Air cleaner body.
10. Unloader.



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## AIR CLEANER-DUAL ELEMENT

### FILTER ELEMENT SERVICE

#### WASHING

Inspect both elements for damage and replace if needed. Clean primary element (5, Figs. 2-3, 2-4) by washing in a warm water solution of household detergent. DO NOT OIL ELEMENTS. Never wash element with anything other than water and detergent. Do not try to take element apart or tap it against a hard surface.

Rinse element carefully in clear water and shake it gently to remove excess water. Lay element on its side and allow it to air dry gefore re-installing. Overnight drying is usually sufficient. When drying element, protect it from dirt and/or freezing.

It is suggested that spare elements be available for use while the serviced element is drying. This will reduce unit downtime to only a few minutes and will allow sufficient time to properly service the restricted element.

NOTE: After cleaning, if an element is to be stored for later use, place it in a plastic bag and store in an element shipping container to protect against dirt and damage.

The primary filter element must be replaced after six washings.

#### COMPRESSED AIR

As an emergency measure only, element may be cleaned with compressed air, not to exceed 100 psi. at the nozzle and at a reasonable distance from element. Direct compressed air opposite to the normal operating air flow through the element.

NOTE: ONLY the primary element may be cleaned. When the safety element (8, Figs. 2-3, 2-4) becomes dirty it must be replaced.

NOTE: If the safety element (8, Figs. 2-3, 2-4) is ruptured, no matter how slightly, it must be replaced.

#### UNLOADING VALVE AND AIR CLEANER BODY

Wipe inside of air cleaner body (9, Figs. 2-3, 2-4) with a clean damp cloth. A small amount of non-sudsing detergent added to water will facilitate soot removal.

Squeeze rubber lips of unloading valve to remove any residual dust or dirt and to be certain that valve is not blocked or inoperative.

### ASSEMBLY

Install safety element (8, Figs. 2-3, 2-4) on support in air cleaner body and secure it with washer (7) and stop nut (6).

Slide clean primary element (5) over safety element and secure with seal washer (4) and wing bolt (3).

Position cover (2, Figs. 2-3, 2-4) on air cleaner body (9) and secure with wing nut (1, Fig. 2-4) or clamp (1, Fig. 2-3).

### INSTALLATION

Position cleaner mounting clamps on cleaner body and snug but do not tighten.

Position cleaner in tractor with cleaner air inlet pipe vertical and protruding from bore in hood. Secure mounting clamps to tractor with cap screws and lock washers.

Install inlet hood and tube assembly on cleaner inlet and tighten clamp securely.

Install air cleaner to engine hose and secure with hose clamps.

Tighten air cleaner mounting clamps securely.

## FUEL SYSTEM

### GENERAL

The fuel used in your diesel engine should have the proper combustion characteristics to secure the highest measure of performance and economy. CLEANLINESS of the fuel system is most important because of the harmful effect which impurities, particularly those of an abrasive nature, may have upon the fuel injection system.

Each system contains a similar routing of fuel to the fuel injection pump. The fuel system should be serviced regularly. Refer to Operator's Manual, OM-H-100C for recommended interval.

### FUEL TANK REMOVAL AND INSTALLATION

#### REMOVAL

Removal procedure of the fuel tank is similar for either engine power. Drain fuel tank before tank is removed from tractor frame by removing drain plugs from front bottom portion of tank.

Disconnect fuel supply line and fuel return line at front top of tank. Remove hardware that attaches International Harvester engine oil drain outlet to fuel tank and wire outlet and drain hose to engine, out of the way.

Remove electrical lead to the fuel sender. With the aid of suitable blocking, install a hydraulic jack tightly against the tank.

From within engine compartment remove mounting hardware from tank and frame mounting brackets and gently lower tank from frame.

#### INSTALLATION

Use a hydraulic jack and suitable blocking to raise fuel tank into tractor frame. Align fuel tank and frame mounting brackets and install and tighten mounting hardware from within engine compartment.

Connect International Harvester engine oil drain outlet to front of fuel tank and fuel outlet and return lines to front top of the tank. Connect lead to fuel level sender. Replace drain plugs in front bottom of tank, refill tank with clean fuel and start the engine. Check for and correct any fuel leaks.



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## FUEL FILTER SERVICE

The International Harvester engine is equipped with two fuel filters. The primary filter (3, Fig. 2-5) is located on the right front corner of the engine. The final filter (1) is mounted just forward of center on the right side of the engine, next to the engine oil filters (2).

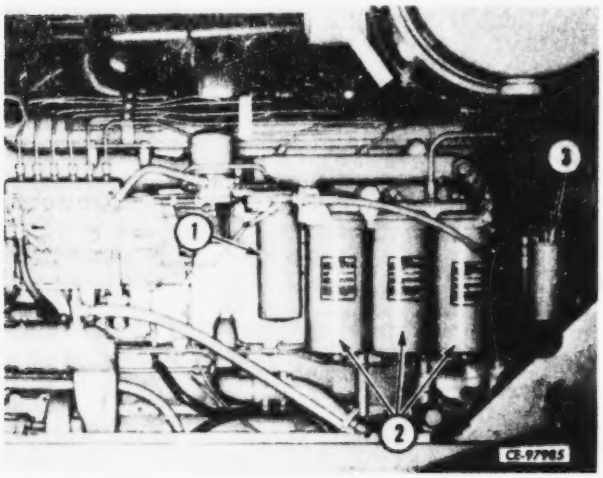


Figure 2-5
Fuel and Oil Filters.

Only the primary filter has a replaceable element. To replace the primary filter element, thoroughly clean the filter case, then remove the retainer bolt at the top center of the filter head. Remove case and used element. Discard element and used gasket. Thoroughly clean filter case with clean fuel. Install new element and gasket and assemble to filter head. Tighten retainer bolt.

Cleanliness cannot be overemphasized. Be careful not to allow dirt, water and other foreign materials to get on new filter. Keep new filters in original package until ready for installation.

The final filter is the "throw-away" pleated paper type. To replace the final filter, unscrew it from the filter header and discard it.

Thoroughly clean the filter header with kerosene or diesel fuel to prevent dirt or foreign matter from falling into the new filter.

Apply a light coating of clean engine oil or chassis lube to the seal surface of the new filter. Thread the new filter onto the header-DO NOT "spin" the filter. Turn filter onto header until seal just contacts the header. Make aligning marks on the filter and header; give the filter an additional 1/4 to 1/2 turn.

NOTE: Do not use any tool for installation.

The Cummins engine employs one large fuel filter having a replaceable element.

Replace filter element when loss of power or engine misfiring may indicate fuel filter is restricted. If filter case is equipped with a drain cock, open drain cock and wash filter case with the draining fuel. Always thoroughly clean filter case before loosening the case retaining screw to prevent entry of dirt or foreign material.

Unscrew filter case retaining screw and remove case and element.

Remove and discard used element and cover gasket. Thoroughly clean filter head and case, inside and out, with diesel fuel or kerosene.

NOTE: Always keep new filter element in its container until ready for installation.

Install new element in filter case and fill case with fresh, clean fuel. Place a new gasket in cover and install case to cover. Install and tighten case retaining screw. DO NOT "spin" the case on cover as this might cause cover gasket to shift. After completing filter change, start engine and check for fuel leaks. If any are found, correct condition before putting tractor back into service.

# ENGINE

## SERVICE INFORMATION

### SPECIFICATIONS

ENGINES

| | |
|---|---|
| Make | International Harvester |
| Model | DT-817B |
| Type | Turbocharger, four stroke cycle, diesel |
| Rated horsepower: (2100 rpm) | 320 |
| Net torque: (1450 rpm) | 891 ft. lb. |
| Number of cylinders | 6 |
| Bore | 5-3/8 in. |
| Stroke | 6 in. |
| Piston displacement | 817 cu. in. |
| Low idle speed, rpm | 650-750 |
| High idle speed, rpm | 2200-2350 |

| | |
|---|---|
| Make | Cummins |
| Model | NT-855-C |
| Type | Turbocharger, four stroke cycle, diesel |
| Rated horsepower: (2100 rpm) | 310 |
| Net torque: (1550 rpm) | 806 ft. lb. |
| Number of cylinders | 6 |
| Bore | 5-1/2 in. |
| Stroke | 6 in. |
| Piston displacement | 855 cu. in. |
| Low idle speed, rpm | 600-650 |
| High idle speed, rpm | 2100-2300 |

### LUBRICANTS AND CAPACITIES

| Item | Temp. Range - °F | Type Refill and Designation | | | | Approximate Refill Capacity | |
|---|---|---|---|---|---|---|---|
| | | IH | SAE | API | MIL SPEC | IH DT-817B | CUMM NT-855C |
| Engine Crankcase | 120 to 32<br>60 to -10<br>10 to -25 | | 30<br>10W<br>5W or<br>5W-20 | CD | Series 3 or MIL-L-45199B | 34 qt. with filters | 40 qt. with filter |
| Diesel Fuel System - Normal Service<br>Extended Idling or → | to 10<br>Below 10 | | | Grade 2D<br>Grade 1D | ASTM D-975 | 115 gal. | 115 gal. |
| Cooling System | Above 32 | | Water and 5% Corrosion Inhibitor Solution | | | 65 qt. | 65 qt. |
| | Below | | Ethylene Glycol | | O-A-00548a | | |

### SPECIAL TORQUES

| | |
|---|---|
| Front mounting brackets-to-flywheel housing, cap screws | 155-165 ft. lbs. |
| Front mounting brackets-to-tractor frame, cap screws | 450-500 ft. lbs. |
| Fan end mounting bracket, cap screws | 300-330 ft. lbs. |
| Rear mounting bracket-to-tractor frame, cap screws | 315 ft. lbs. |



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## SERVICE INFORMATION

### NORMAL GAUGE READINGS

| SYSTEM | GAUGE | I. H. C. DT-817B | | CUMMINS NT-855C | |
|---|---|---|---|---|---|
| | | Minimum | Maximum | Minimum | Maximum |
| ENGINE | Water Temperature (degrees Fahrenheit) | 180 | 195 | 180 | 195 |
| | Oil Pressure (psi) | 45* | 60* | 15* | 75* |
| TACHOMETER | Low Idle (rpm) | 650 | 750 | 600 | 650 |
| | High Idle (rpm) | 2200 | 2350 | 2100 | 2300 |
| | Governed Speed (rpm) | 2100 | | 2100 | |
| | Converter Stall (rpm) | 2060 | 2160 | 2000 | 2100 |
| | Hydraulic Stall (rpm) | 2000 | 2200 | 2000 | 2200 |
| | Full Stall (rpm) | 1480 | 1650 | 1480 | 1590 |

* At 2310 ± 50 rpm

# ENGINE

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
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# SECTION III

# TORQUE CONVERTER

SECTION III TORQUE CONVERTER


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## GENERAL INFORMATION

### DESCRIPTION

The converter housing contains a single stage, single phase, three element torque converter, an input charging pump and a power take-off to drive the loader system pump and the combination power steering-cooling circuit pump.

The power take-off gear, fixed to the torque converter impeller drives a pair of pump gears mounted to the accessory drive housing. The loader system pump and the power steering pump are splined to the hubs of the pump gears.

# TORQUE CONVERTER

## GENERAL INFORMATION

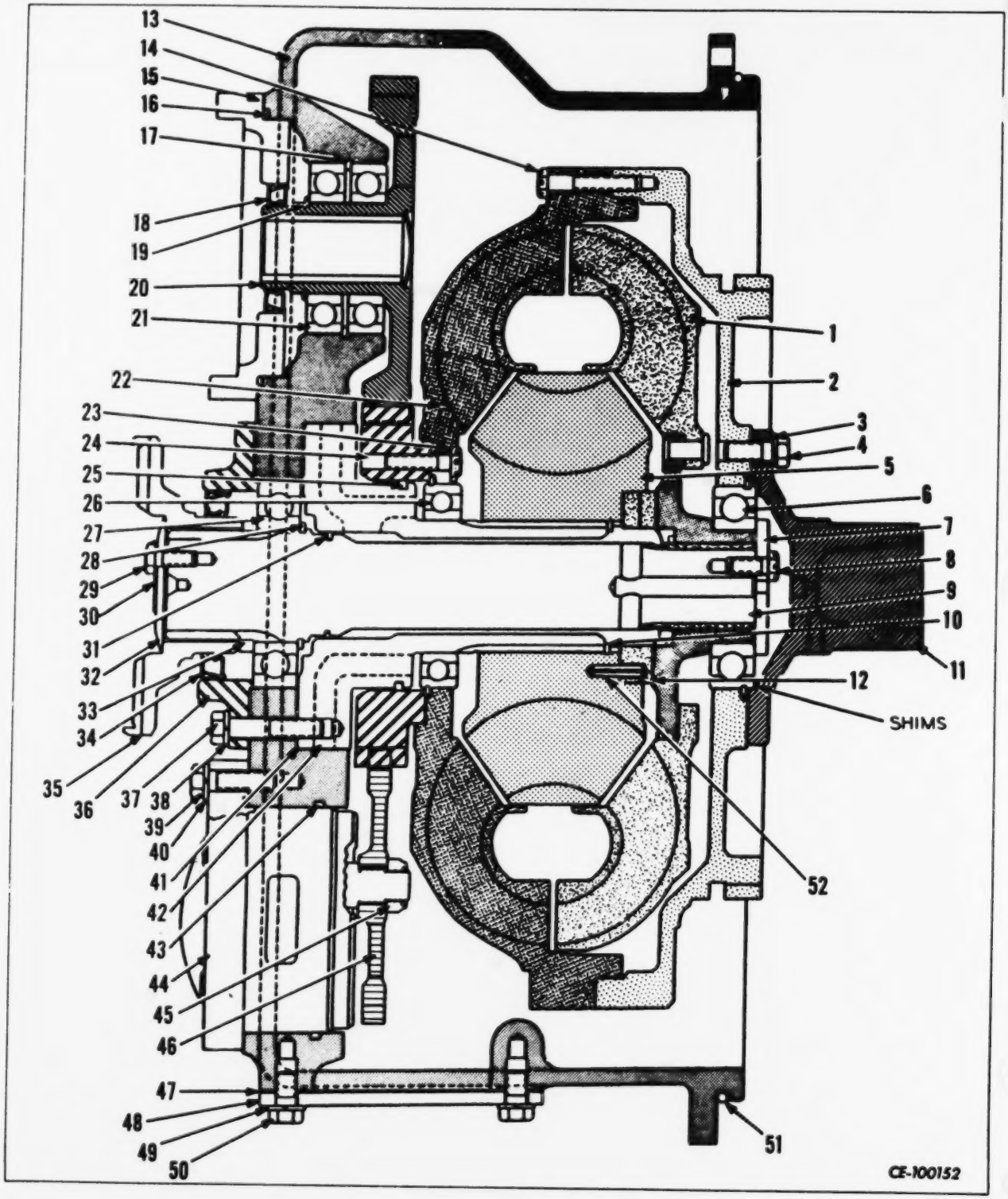


Figure 3-1
Torque Converter and Accessory Drive

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## GENERAL INFORMATION

Legend for Figure 3-1

1. Turbine.
2. Drive housing.
3. Lock washer.
4. Cap screw.
5. Stator.
6. Bearing.
7. Washer.
8. Cap screw.
9. Output shaft.
10. Snap ring.
11. Input hub.
12. Spacer.
13. Housing.
14. Cap screw.
15. Adapter.
16. "O" ring.
17. Snap ring.
18. Oil seal.
19. Snap ring.
20. Hydraulic pump drive gear assembly.
21. Bearing.
22. Impeller.
23. Cap screw.
24. Gear.
25. Seal ring.
26. Bearing.
27. Bearing.
28. Snap ring.
29. Cap screw.
30. Locking plate.
31. Seal ring.
32. Washer.
33. Spacer.
34. Oil seal.
35. Output yoke.
36. Retainer.
37. Cap screw.
38. Lock washer.
39. Cap screw.
40. Lock washer.
41. Gasket.
42. Ground sleeve hub.
43. "O" ring.
44. Input pump.
45. Nut.
46. Input pump driving gear.
47. Gasket.
48. Inspection cover.
49. Lock washer.
50. Cap screw.
51. Seal ring.
52. Dowel pin.

## PREVENTIVE MAINTENANCE

### OIL LEVEL CHECK AND CHANGE PERIODS

The torque converter and transmission share a common charging pump. Torque converter fluid is, therefore, serviced along with the transmission. See Section IV, "TRANSMISSION."

### CONVERTER STALL CHECK

A full power stall check is made to determine whether or not the engine has rated power and if converter and transmission are operating correctly.

NOTE: Before making a stall check, accelerate the engine to 1000 rpm with transmission in neutral. At 1000 rpm, clutch pressure should equal recommended minimum (refer to "SPECIFICATIONS"). If this minimum pressure is not obtained DO NOT MAKE THE STALL CHECK. If clutch pressure is below minimum clutches will slip and burn at full stall.

A stall check is accomplished by:

1. Engine, converter and transmission operating at proper temperature.

2. Apply parking brake.

3. Run the engine to be sure it will operate at high idle (refer to "SPECIFICATIONS").

4. Shift transmission to either forward or reverse direction and fourth range.

5. Depress the accelerator to its maximum position and record the engine rpm. Refer to "SPECIFICATIONS" for stall speed limitations.

# TORQUE CONVERTER

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### REMOVAL

Drain hydraulic reservoir.

Disconnect battery cables, ground cable first. Disconnect positive (hot) cable at starter. Remove cable clamps.

> NOTE: Whenever lines are disconnected, both open line ends should be capped immediately to prevent the entrance of dirt. Open valve and pump ports should be plugged. Serious damage to system components may result due to the entrance of tiny particles of foreign material in the fluid.

Remove all hood sides (3, Fig. 3-2). Remove hood retaining cap screws from forward end of hood (2). Loosen rear cap screws. Securely block forward end of hood. Blocking should be high enough to allow a slight gap between hood and bulkhead.

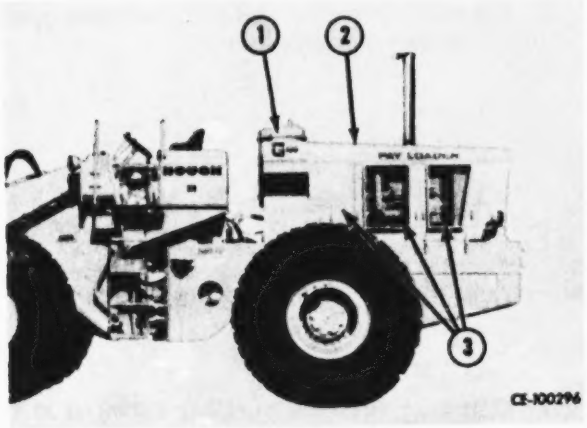


Figure 3-2

Remove reservoir to pump tubes (3, Fig. 3-3), reservoir to bracket tube (1) and reservoir to cooler hose (2) from reservoir.

Disconnect transmission filter lines at filter. Tag lines for proper identification during assembly.

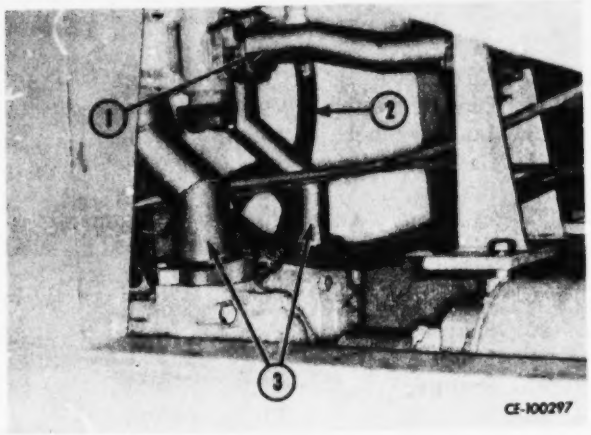


Figure 3-3

Disconnect cold weather starting aid lines from bracket. Tag all lines.

Disconnect drive from tachometer.

Disconnect line from air cleaner restriction indicator.

Secure bulkhead assembly to a hoist of sufficient capacity using a suitable sling. Remove cap screws, nuts and lock washers that secure bulkhead assembly to rear main frame. Move bulkhead slightly forward to clear hood, then raise entire assembly from tractor.

> NOTE: While raising bulkhead from the tractor be sure all wires, hoses and tubes have been disconnected.

Remove drive shaft between converter and transmission. Wire up bearing caps to avoid loss.

Disconnect all transmission and torque converter hoses at the converter. Tag all hoses for identification.

Disconnect electrical leads.

Disconnect breather line from elbow on top of converter housing.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Secure converter in a suitable sling attached to hoist. Remove slack from hoist. Remove cap screws and lock washers that secure converter to engine flywheel housing. Carefully remove converter. Punch mark the converter drive ring and rotating housing for assembly.

Move converter to disassembly area.

### DISASSEMBLY PREPARATION

Disassembly preparation should include:

Disconnecting all external lines from housing.

Provisions for steam cleaning the converter and surrounding area. Do not use caustic soda.

Preparing a dirt free work area at least 12 feet square.

A suitable hoist.

The following tools:

a. Low table or bench for disassembly.

b. Shop press.

c. Solvent for cleaning parts.

d. Standard set of mechanic's hand tools.

e. Snap ring pliers.

f. Torque wrench - 100 ft. lbs. capacity.

g. Mallet (preferably plastic).

h. A steel tube 6-1/2" I. D. x 9" with at least 1/4" wall thickness.

i. A steel plate 3-3/4" dia. x 3/4" thick.

Pans for holding small parts during disassembly.

### DISASSEMBLY

Clean torque converter exterior and surrounding area thoroughly with plain steam (no caustic soda). Prepare a clean work area. Cleanliness is very important during converter overhaul.

When a converter is removed from the tractor, all open lines and ports on both converter and its attaching lines must be plugged with plastic caps.

NOTE: Do not use rag to plug ports or lines.

Position converter on a bench with output yoke (1, Fig. 3-4) facing down. Block housing so yoke will clear bench.

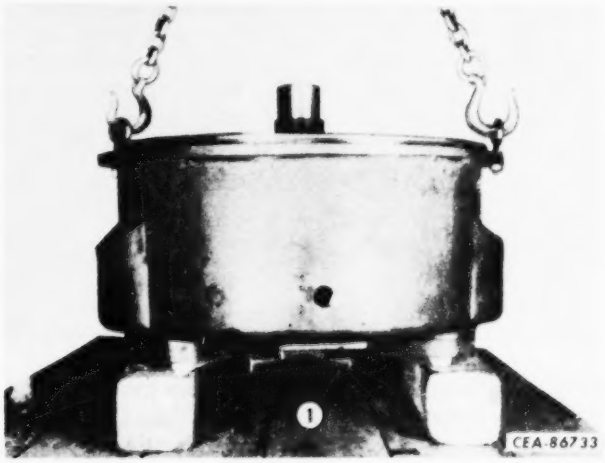


Figure 3-4

Remove the seal ring (1, Fig. 3-5) from the drive housing (2). Discard the seal ring.

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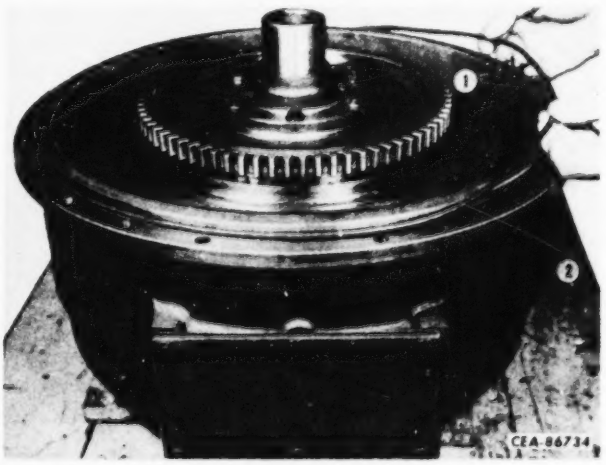


Figure 3-5

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DISASSEMBLY - Continued

Remove cap screws and lock washers that secure pump inspection cover (2, Fig. 3-6). Remove cover and gasket (1) and discard gasket.

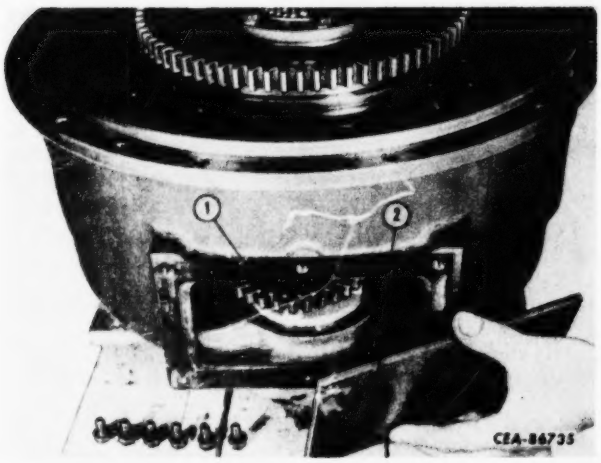


Figure 3-6

Remove cap screws (4, Fig. 3-7) and lock washers that secure hub (1) to drive housing (3). Remove hub and shims (2). Tie shims together to facilitate assembly.

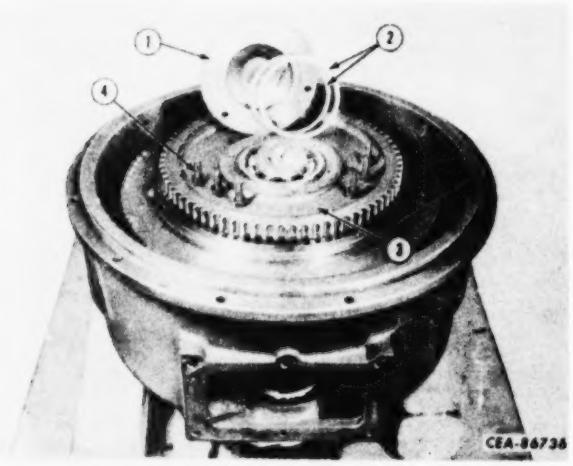


Figure 3-7

Remove screws (1, Fig. 3-8) and lockplate (2) that secure retaining washer (3) to output shaft. Remove retaining washer and shims (4) (if any). Tie shims together to facilitate assembly. Discard cap screw locking plate.

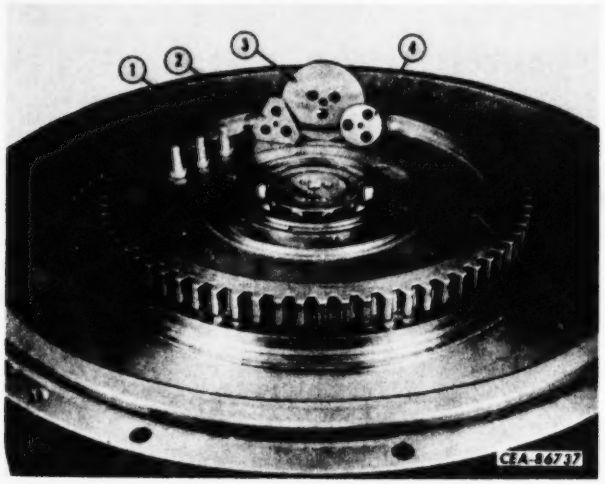


Figure 3-8

Using a suitable hoist, lift converter assembly (1, Fig. 3-9) from converter housing (2).

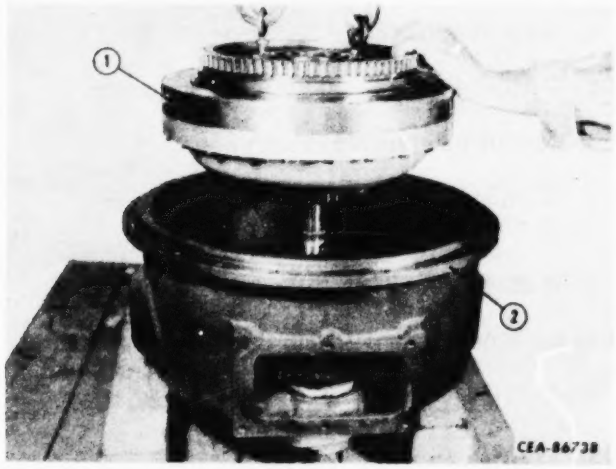


Figure 3-9

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Place converter assembly on bench, drive housing (1, Fig. 3-10) up. Block impeller high enough to allow accessory drive gear (2) to clear bench.

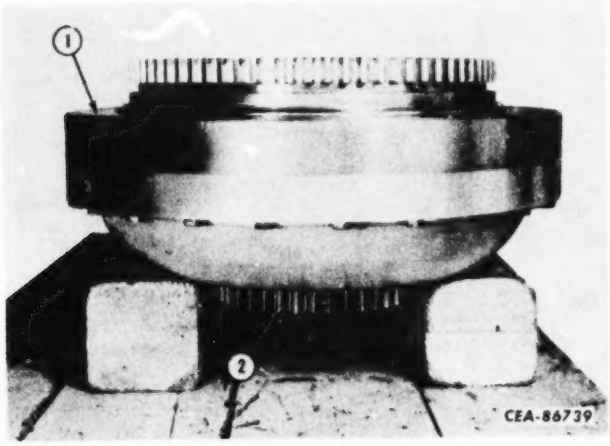


Figure 3-10

Remove cap screws (3, Fig. 3-11) that secure impeller (2) to drive housing (1).

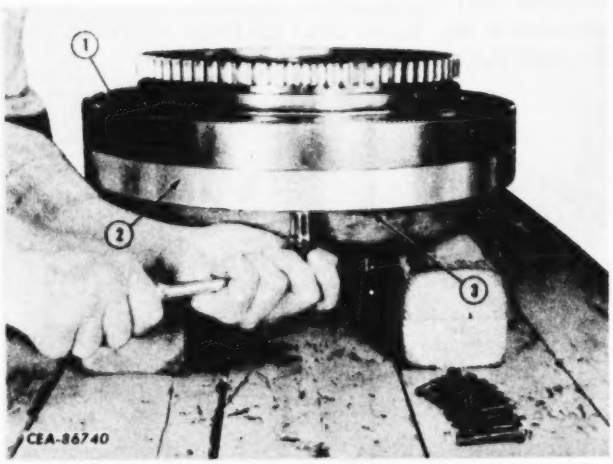


Figure 3-11

Using a suitable hoist lift drive housing (1, Fig. 3-12) and attached turbine from converter assembly.

NOTE: Do not drop turbine as it is removed from converter assembly.

Invert housing and turbine assembly and pull turbine from drive housing.

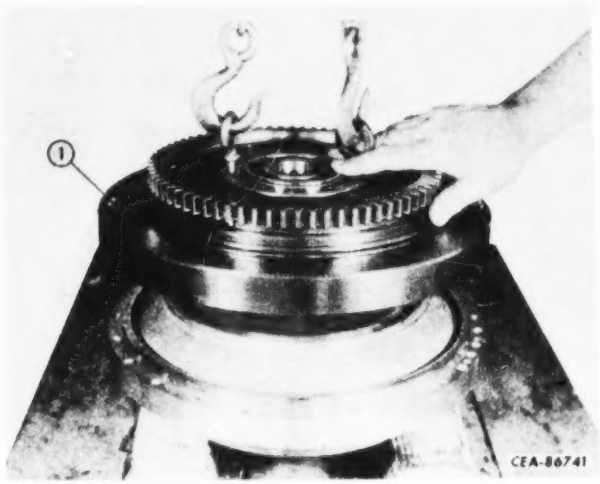


Figure 3-12

To remove bearing (2, Fig. 3-13) use a suitable driver (1) on outer bearing race and drive bearing from drive housing.

(Continued on next page)

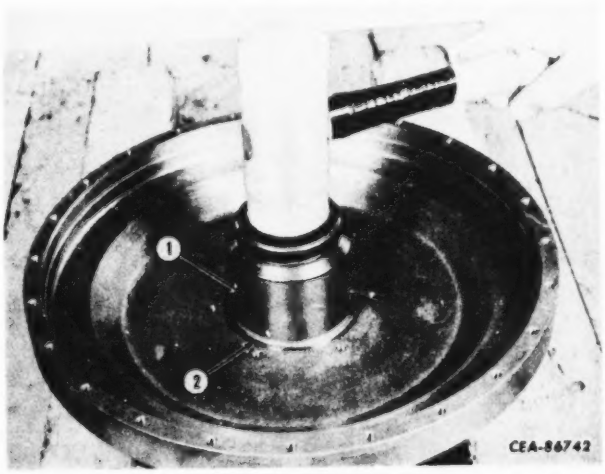


Figure 3-13

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DISASSEMBLY - Continued

Remove spacer (1, Fig. 3-14) from dowel (2) in stator (3) and remove stator.

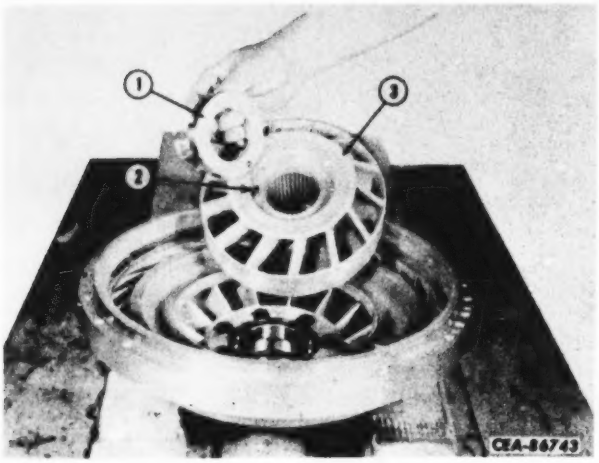


Figure 3-14

Remove cap screws (2, Fig. 3-15) that retain accessory drive gear to impeller (1). Tap hub bearing and gear from impeller.

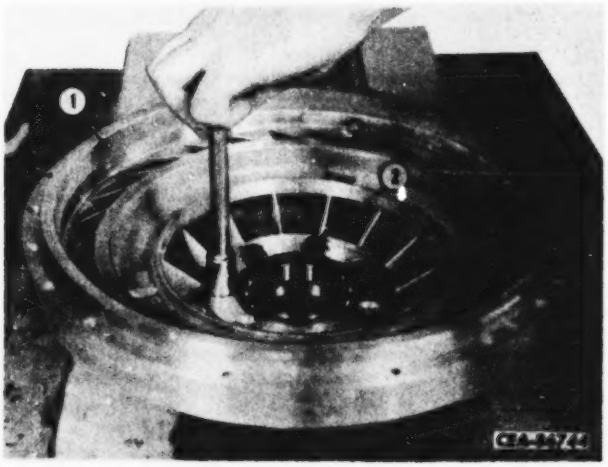


Figure 3-15

Position converter housing (4, Fig. 3-16) on blocking with output yoke (1) facing up.

Remove cap screws (2) and locking plate (3) that secure retaining washer to output shaft. Remove retaining washer and output yoke.

Figure 3-16

Remove cap screws and lock washers that secure bearing retainer (1, Fig. 3-17) and ground sleeve hub to converter housing (6). Remove bearing retainer and seal assembly (1) and shims (2). Drive seal (3) from retainer. Discard seal and retainer gasket (4).

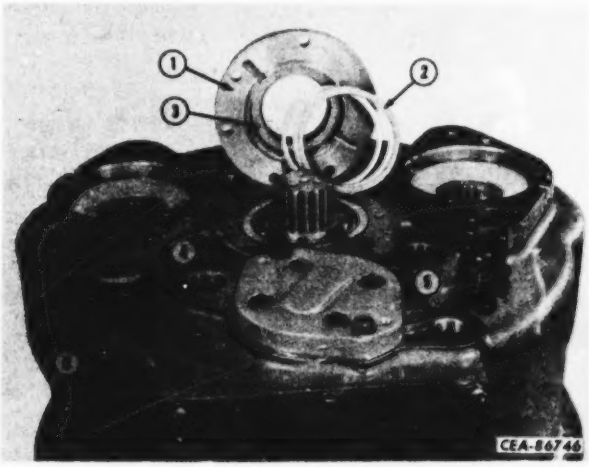


Figure 3-17

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Tie shims to bearing retainer to prevent loss. Remove yoke spacer (5).

Invert converter housing on blocking with open end up. Remove snap ring (2, Fig. 3-18) from groove in upper end of output shaft. Tap on output shaft (1) with a soft mallet or drift until shaft bearing is free of housing.

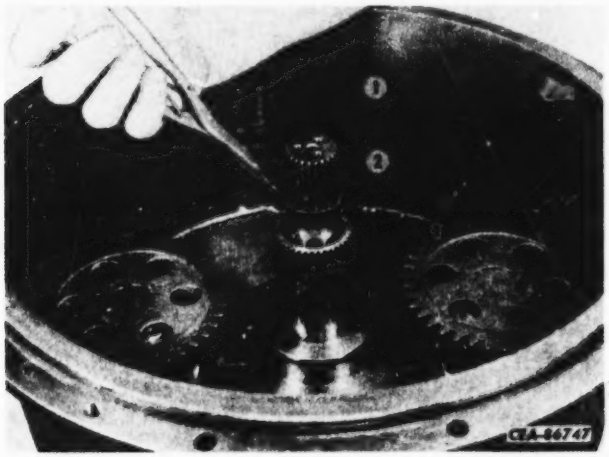


Figure 3-18

Remove hook-type seal ring (1, Fig. 3-19) and snap ring (2) from output shaft.

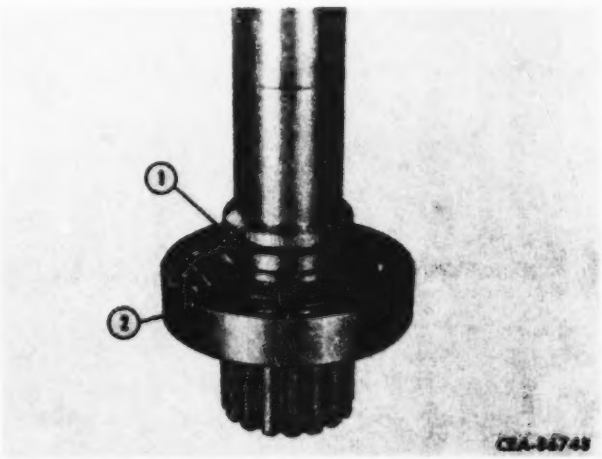


Figure 3-19

Support inner race (1, Fig. 3-20) of bearing in a press and press output shaft out of bearing.

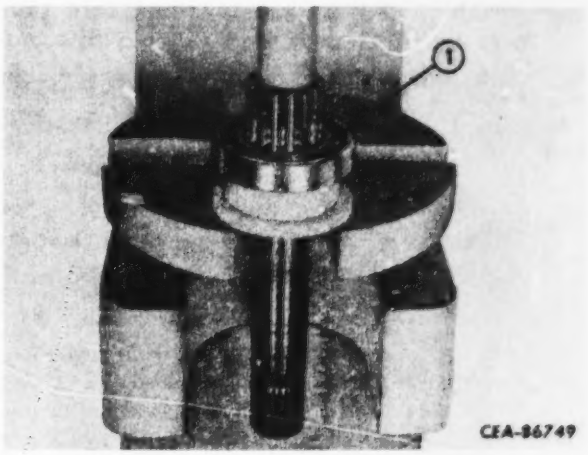


Figure 3-20

Remove retaining nut and input charging pump drive gear (1, Fig. 3-21). Use a punch to keep drive gear from rotating.

(Continued on next page)

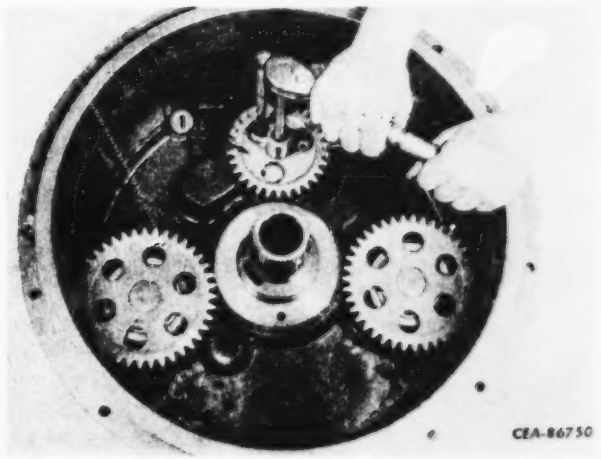


Figure 3-21

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DISASSEMBLY - Continued

Invert converter housing (1, Fig. 3-22) and remove pump retaining cap screws (2) and lock washers.

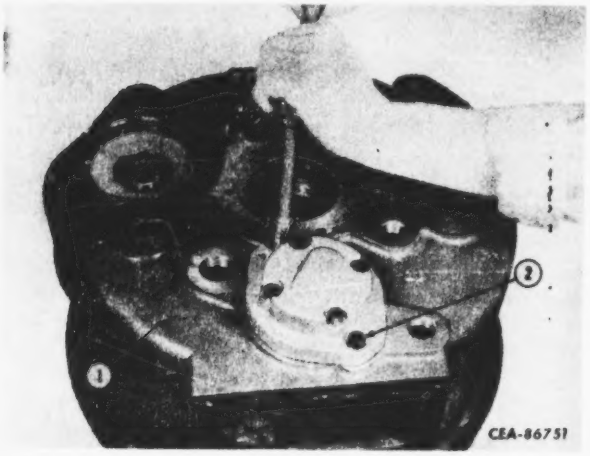


Figure 3-22

Install 2-3/8" x 3" N. C. cap screws (1, Fig. 3-23) in threaded jack screw holes. Rotate jack screws equally to remove pump from housing.

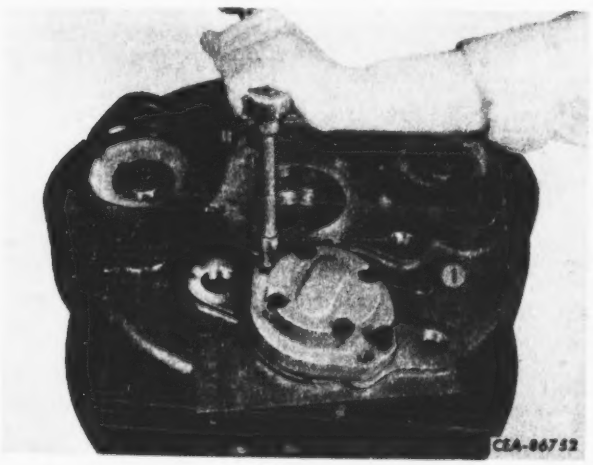


Figure 3-23

Remove "O" rings from pump flange (1, Fig. 3-24) and converter housing (2) and discard rings.

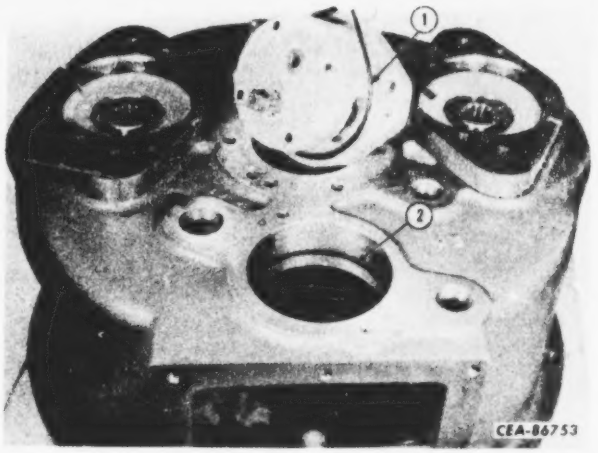


Figure 3-24

Insert main hydraulic pump mounting cap screws in threaded jackscrew holes in pump mount adapter plate (1, Fig. 3-25). Remove plate and seal assembly by rotating jackscrews equally. Remove snap ring (4) from gear shaft (3). Using a soft mallet or drift, drive gear from bearings. Drive seal (2) from adapter plate.

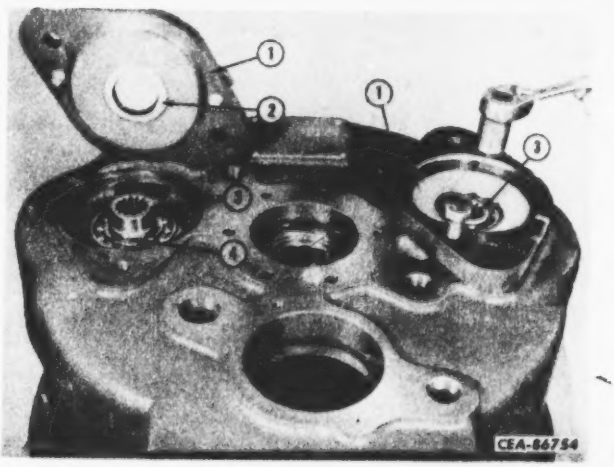


Figure 3-25

## DISASSEMBLY, INSPECTION AND ASSEMBLY

To remove bearings tap inner bearing out of front of housing and outer bearing (2, Fig. 3-26) out toward rear of housing. Do not remove snap ring (1) unless it is chipped, cracked or broken.

NOTE: Repeat above two operations for remaining pump drive gear assembly.

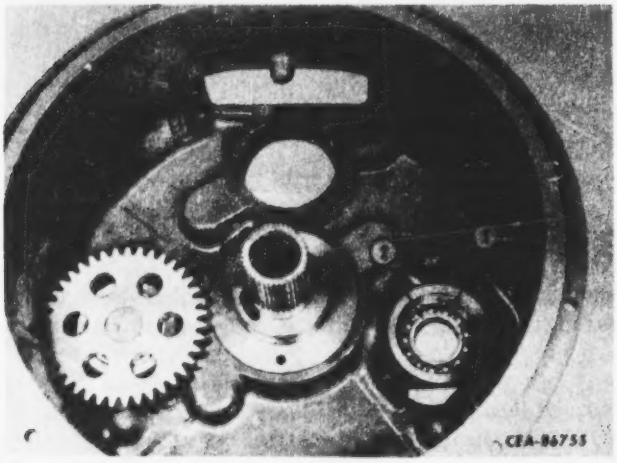


Figure 3-26

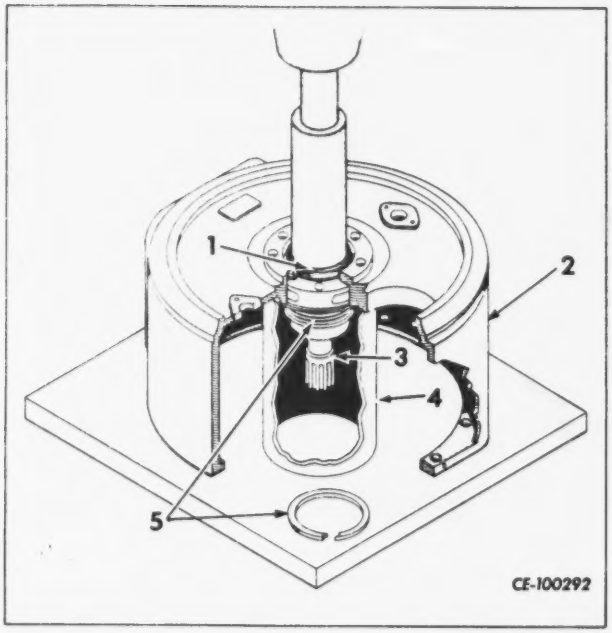


Figure 3-27

To remove ground sleeve hub, remove seal ring (5, Fig. 3-27) from hub (3). Place converter housing in a press with splined end of ground sleeve hub down. Support center of housing with a steel sleeve (4) (6-1/2" I. D. x 9" long with 1/4" wall thickness). Sleeve must not contact hub. Place a steel disc (1) 3-3/4" x 3/4" in center of hub and press out hub. Discard gasket.

NOTE: Do not attempt to drive ground sleeve from converter housing as serious damage may be incurred by both housing and ground sleeve.

## CLEANING AND INSPECTION

### CLEANING

Clean all metal parts in cleaning solvent and dry with compressed air. Lubricate all machined surfaces with clean oil. During the cleaning operation, give particular attention to oil passages, bearing assemblies, bearing bores, snap and seal ring grooves and screw threads.

### INSPECTION

Inspect all parts for wear or damage. Check the converter and rotating housings for cracks. Inspect the bearing bores and mounting faces for wear, grooves or scratches. Remove burrs and scratches with a crocus cloth. Inspect all splined parts for worn, twisted, chipped or burred splines. Remove burrs with a soft stone. Check the turbine, impeller and guide wheel for cracks or other damage. Replace any parts that are in doubt or cannot be repaired.

Discard all old oil seals, "O" rings and gaskets. Reusing old gaskets and seals is false economy.

NOTE: Special Torque, Pressure, etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil and revised when necessary.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY

NOTE: The ground sleeve hub must be packed in dry ice or chilled to a temperature of -25°F. for at least 30 minutes prior to assembly.

Place converter housing in a press with output side down. Position a new gasket in housing.

Insert two headless guide screws (1, Fig. 3-28) (3/8" x 3" N. C.) into chilled ground sleeve hub (2) and position hub in converter housing aligning oil passages (3) and bolt holes. Press hub into converter housing.

NOTE: Care must be taken to be sure the ground sleeve is seated.

Remove guide screws (1).

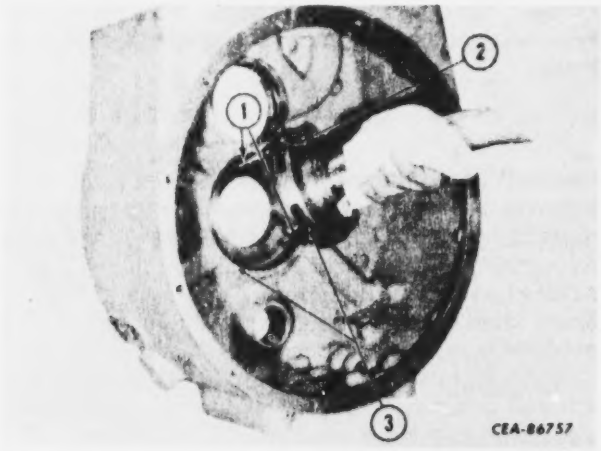


Figure 3-28

Install a new seal ring (2, Fig. 3-29) on hub (1). Be sure to hook ring. Coat ring lightly with heavy grease.

Install snap rings (if removed) in housing bores. Press inner pump drive gear bearings into housing until they bottom on their respective snap rings.

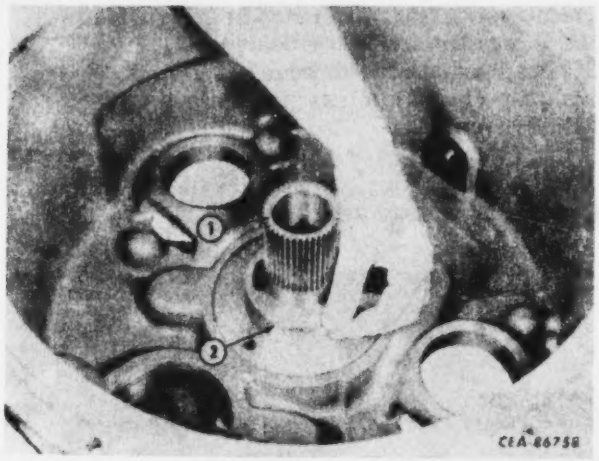


Figure 3-29

Invert housing in press and press in outer bearings (1, Fig. 3-30) until they bottom on snap rings.

NOTE: Apply pressure to the outer bearing races only.

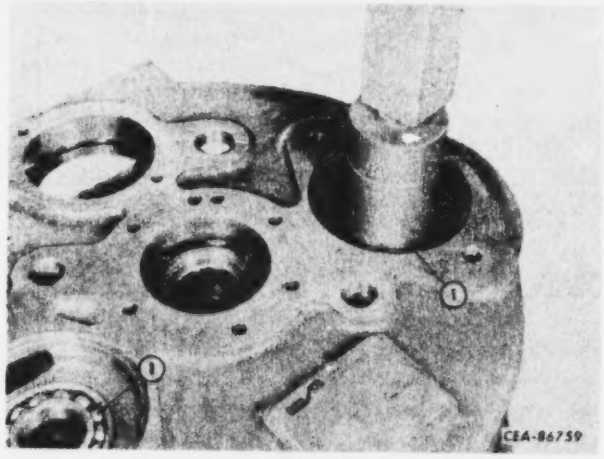


Figure 3-30

Position converter housing (1, Fig. 3-31) in a suitable press and press accessory driven gear (2) into bearings until snap ring groove near end of shaft is exposed and gear shoulder is

## DISASSEMBLY, INSPECTION AND ASSEMBLY

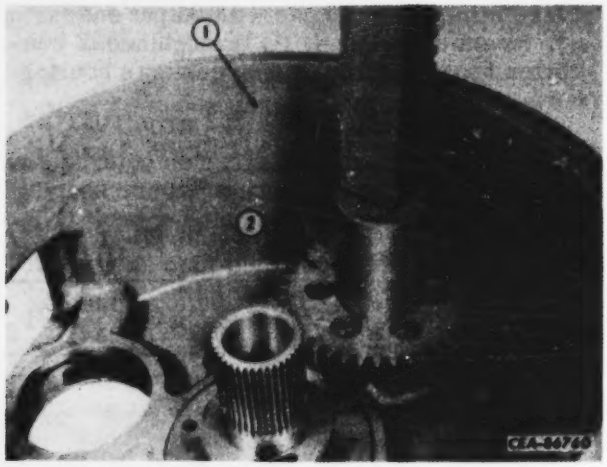


Figure 3-31

bottomed on inner race of inner bearing. Install snap ring. Repeat operation for remaining accessory driven gear.

Install a new "O" ring (2, Fig. 3-32) in housing bore and apply a light coat of heavy grease to bore and "O" ring.

Install new "O" ring (1) in groove in input pump cover.

Press pump in housing bore and retain with cap screws and lock washers. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

NOTE: Care must be taken during pump installation to avoid cutting "O" rings.

Install input pump drive gear (1, Fig. 3-33) on pump shaft. If a snap ring is used on pump shaft, drive gear counterbore must fit over snap ring to be properly positioned. Install retaining nut and tighten to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

NOTE: Use a pin punch to keep gear from rotating.

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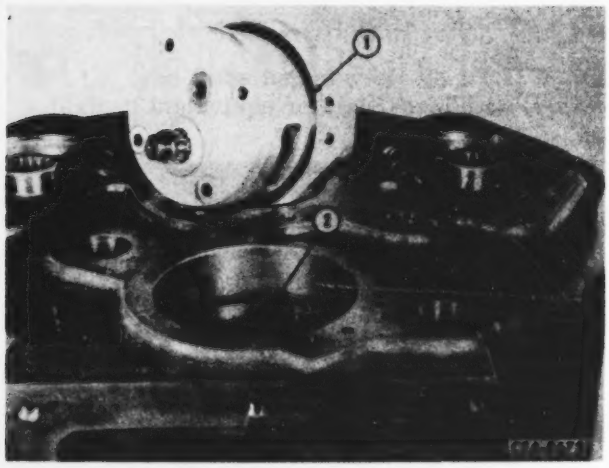


Figure 3-32

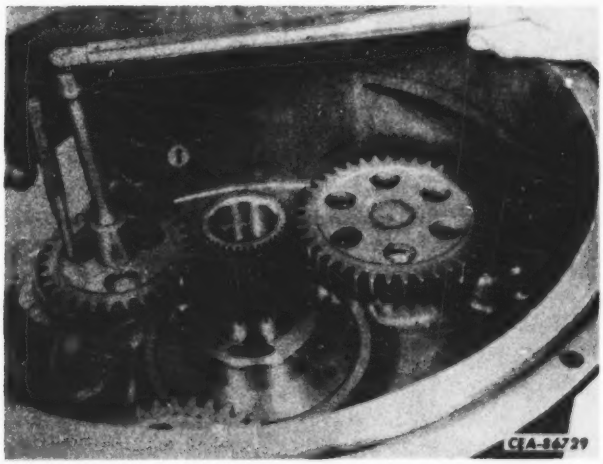


Figure 3-33

## ASSEMBLY - Continued

Install snap ring (2, Fig. 3-34) in its groove in output shaft (1). Press shaft into bearing (3) with output end of shaft entering bearing and seating bearing against snap ring.

NOTE: Support bearing inner race during pressing operation.

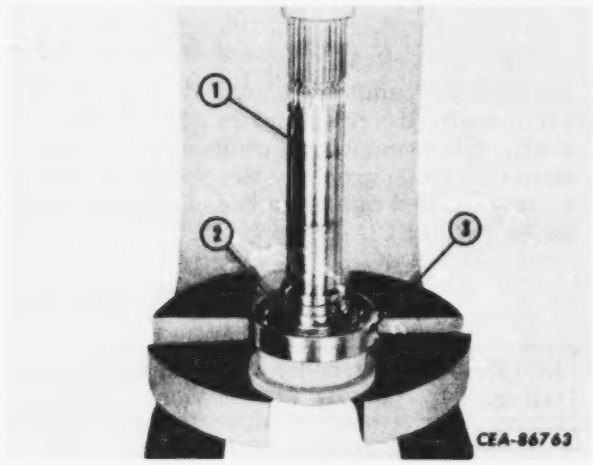


Figure 3-34

Install a new hook-type seal ring (2, Fig. 3-35) in groove in output shaft (1). Be sure ring is hooked. Coat seal ring lightly with a heavy grease.

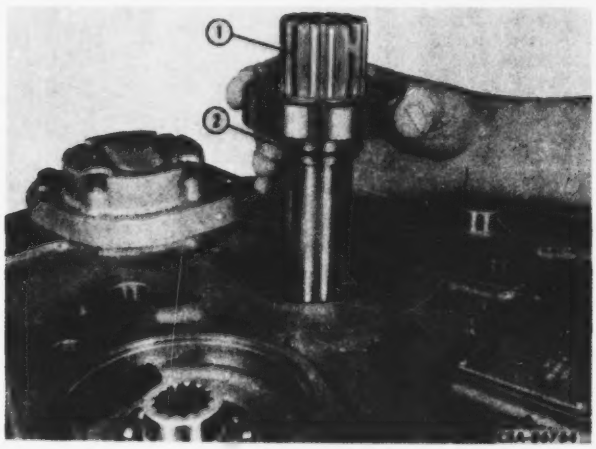


Figure 3-35

Place housing in a press with output end facing up. Insert output shaft (1) through hub of converter housing until bearing contacts housing bore.

Using a suitable sleeve, press on outer race of bearing (1, Fig. 3-36) until shaft and bearing assembly bottom on ground sleeve hub.

NOTE: Extreme care must be exercised to prevent breaking seal ring on shaft.

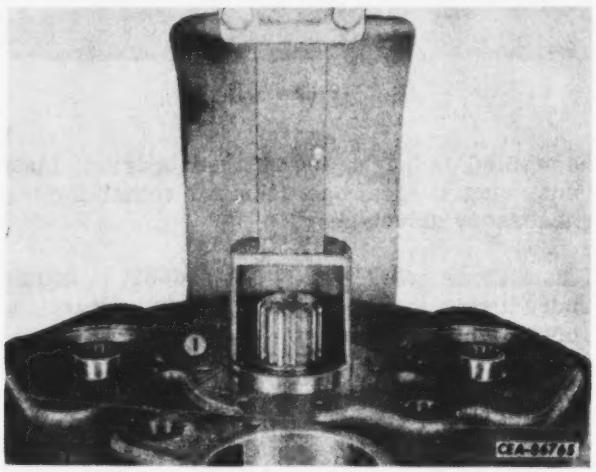

Figure 3-36

Coat O. D. of a new output shaft seal (2, Fig. 3-37) with Mar-Seal, or equivalent sealant.

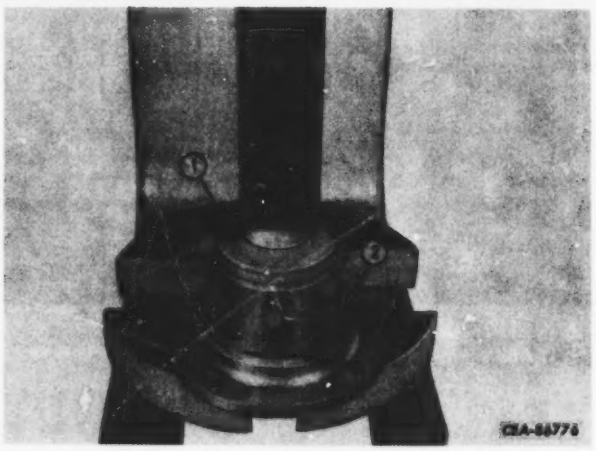

Figure 3-37

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Using a suitable sleeve (1) between press ram and seal, press seal into bore of retainer.

NOTE: Large lip of seal should face down toward large flange end of bearing retainer.

Be sure the output shaft bearing (2, Fig. 3-38) is flush against the ground sleeve hub (3). Using a depth micrometer, measure the distance between the machined surface of the housing (4) and the top of the bearing race (Dimension A). Now, measure the height of the lip on the bearing retainer (1) (Dimension B). Subtract the height of the lip from the depth of the bearing (Dimension A minus Dimension B). The remainder, plus the measured thickness of the retainer-to-housing gasket equals the thickness of the shim pack to be used.

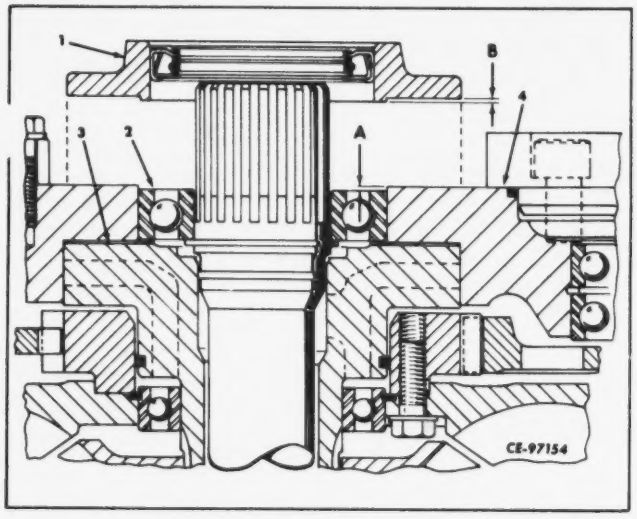


Figure 3-38

Install yoke spacer (1, Fig. 3-39) on output shaft (2).

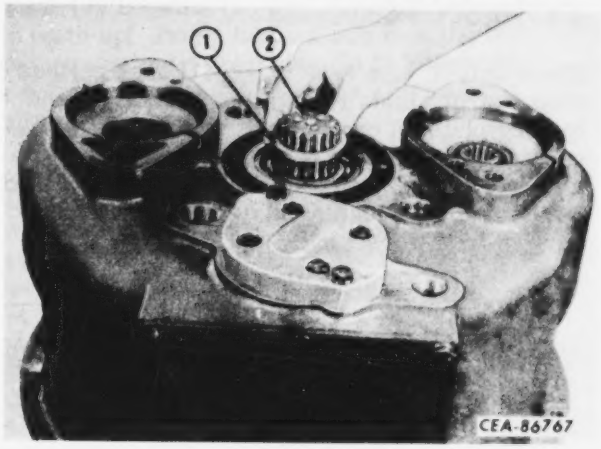


Figure 3-39

Center a new gasket on converter housing and install shim pack and bearing retainer (1, Fig. 3-40) with cap screws and lock washers. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

Figure 3-40

## ASSEMBLY - Continued

Place output yoke (1, Fig. 3-41) over splines of output shaft. Install retaining washer (2) and locking plate on output shaft and secure with cap screws. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES." Bend up tabs of locking plate to prevent cap screws from loosening.

Torque: _____

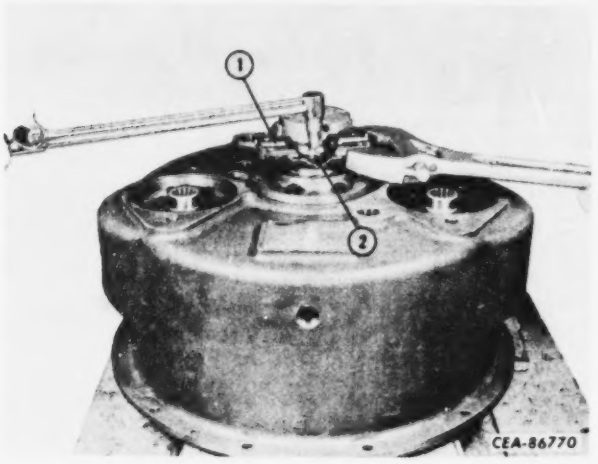


Figure 3-41

Allow housing and shaft assembly to rest on output yoke (1, Fig. 3-42) and block to avoid tipping.

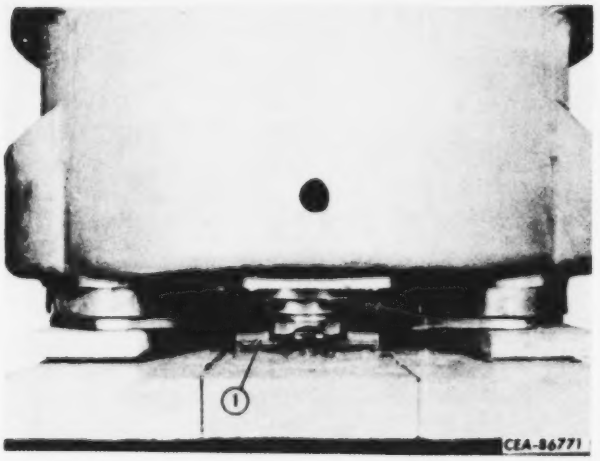


Figure 3-42

Install snap ring (2, Fig. 3-18) in upper groove of output shaft (1).

Block outer flange of impeller (4, Fig. 3-43) with blades down. Using a suitable sleeve (1), drive impeller bearing (2) into bore until snap ring (3) bottoms in its groove in impeller.

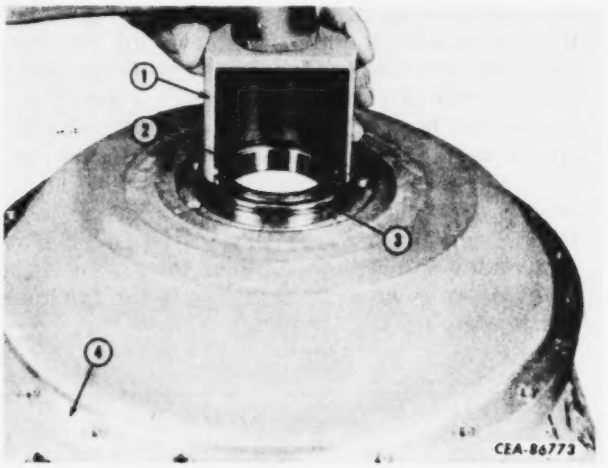


Figure 3-43

Align holes in accessory drive gear (2, Fig. 3-44) with those of impeller, and tap gear with a mallet until it bottoms in recess of impeller. Install retaining cap screws (1) and tighten to recommended torque. Refer to "SPECIAL TORQUES."

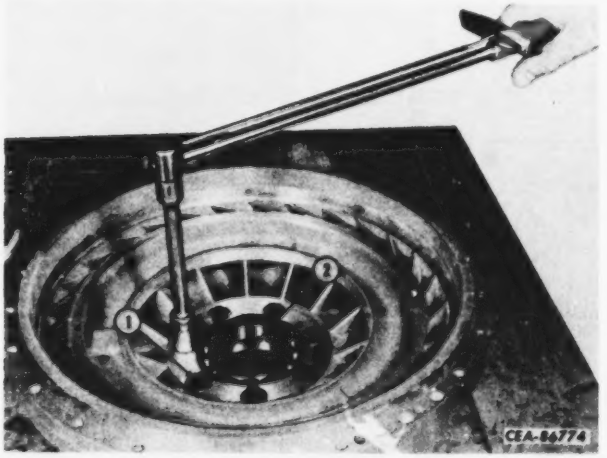


Figure 3-44

## DISASSEMBLY, INSPECTION AND ASSEMBLY

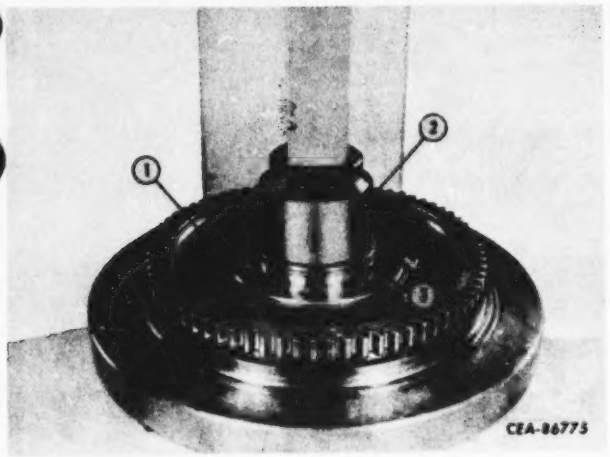


Figure 3-45

NOTE: Units may be equipped with either 5/16" or 7/16" cap screws. Identify size prior to installation.

Torque - 5/16 cap screw:_____
Torque - 7/16 cap screw:_____

Place drive housing (1, Fig. 3-45) in press with gear teeth up. Press turbine hub bearing into drive housing until snap ring (3) is bottomed. Use suitable sleeve (2) and press on bearing outer race only.

Place drive housing (1, Fig. 3-46) on a bench with gear teeth up. Snap ring (3) on bearing (4) must be bottomed in drive housing (1) groove. Place original shim pack in position (5) on outer race of bearing. Place input hub (2) in position over shims and bearing. Apply a firm hand pressure to top of hub and using a single .005" shim (2, Fig. 3-47) (or feeler gauge) check clearance at "A" between hub and drive housing flange surfaces (Fig. 3-46).

Add or subtract shims until a .005" shim (2, Fig. 3-47) just passes between the two flanged surfaces. When correct clearance is obtained, remove hub (1) and shims. Tie shim pack to hub and set aside.

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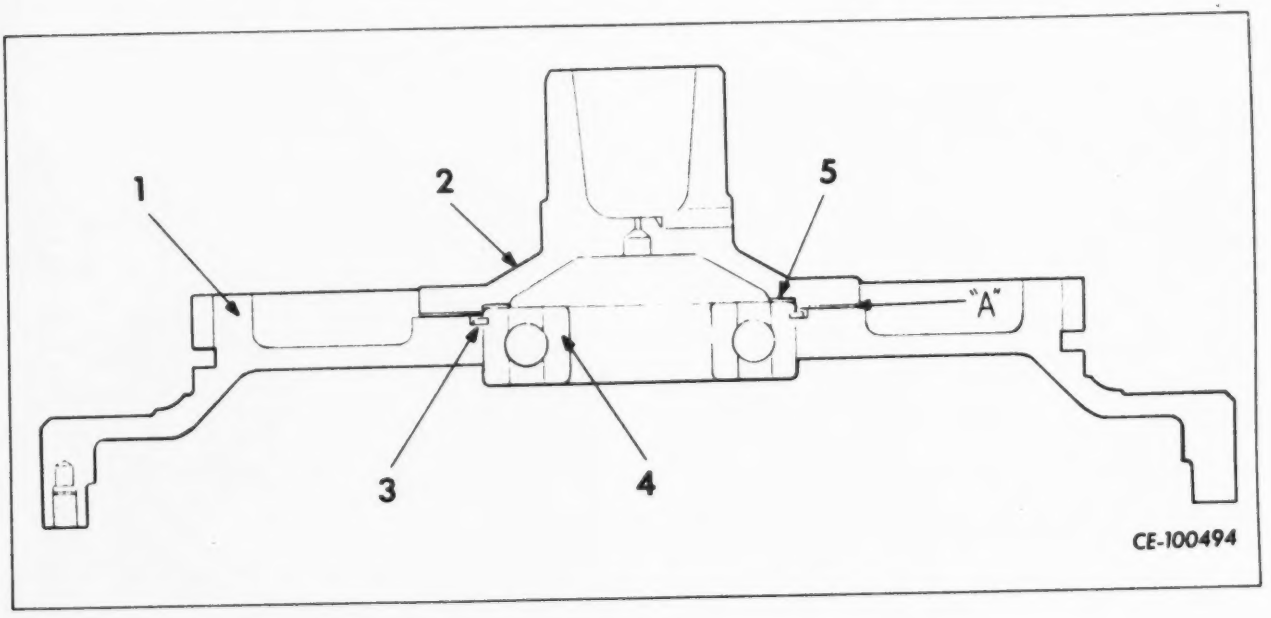


Figure 3-46

## ASSEMBLY - Continued

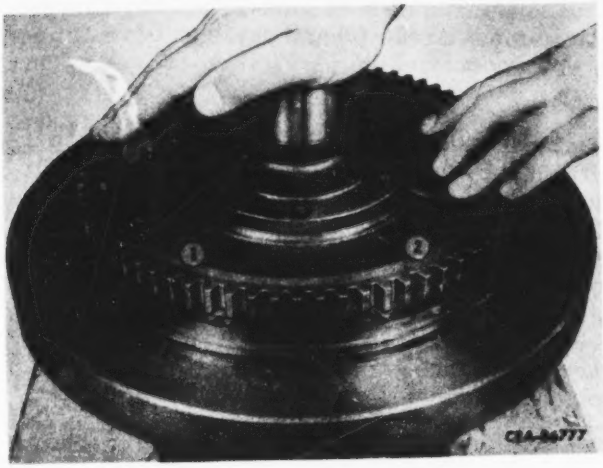

Figure 3-47

Block drive housing (2, Fig. 3-48) on a bench with gear teeth down. Support outer hub bearing race from beneath. Install turbine (1) in drive housing. Be sure shoulder of turbine hub bottoms on inner race of hub bearing.

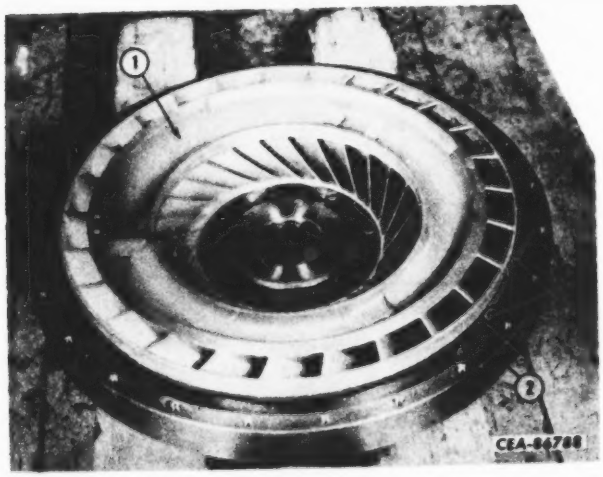

Figure 3-48

Align pin (1, Fig. 3-49) in stator with pin bore (2) in spacer.

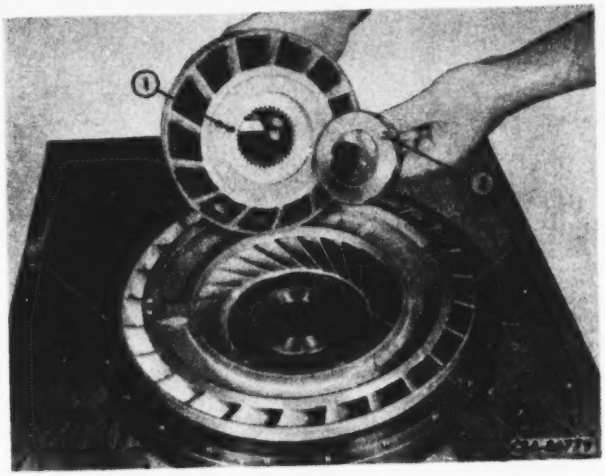

Figure 3-49

Be sure snap ring (1, Fig. 3-50) in bore of stator is correctly positioned. Install spacer in stator.

NOTE: Do not cock spacer. It must make full contact with bottom of its bore in stator.

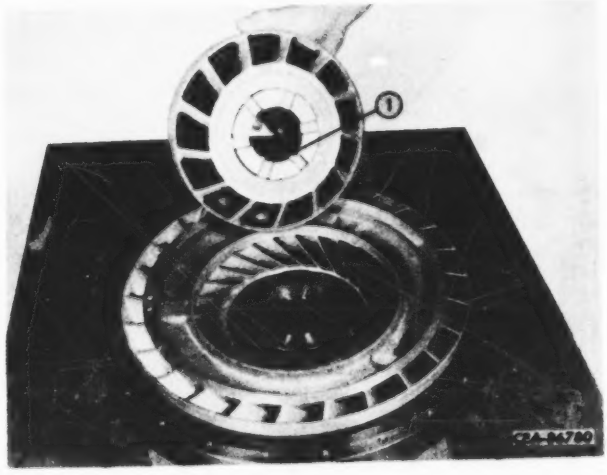

Figure 3-50

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Install stator (1, Fig. 3-51) and spacer assembly in turbine (2) with spacer down.

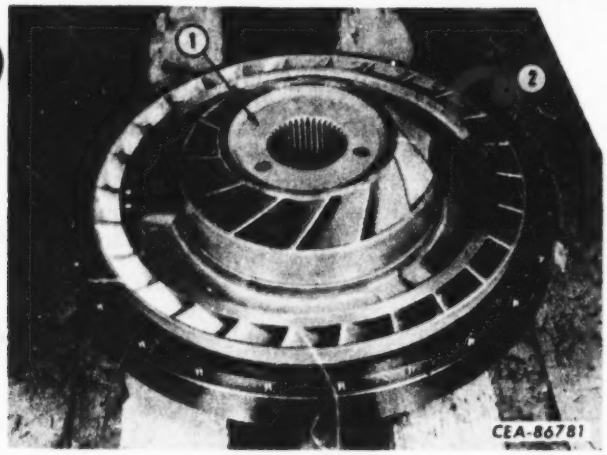


Figure 3-51

Place impeller (1, Fig. 3-52) on drive housing (2) with accessory gear (3) up. Secure assembly with cap screws (4).

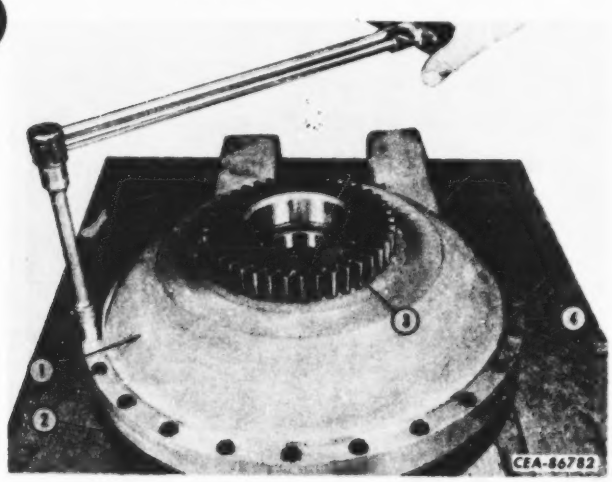


Figure 3-52

Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque:_____

Invert assembly, accessory drive gear (1, Fig. 3-53) down, and attach a hoist to input drive hub mounting holes. Lower assembly into converter housing (2).

While lowering converter assembly into housing, check the following:

a. Stator and ground sleeve hub must spline together.

b. Accessory drive gear must mesh with accessory driven gears and input pump driven gear.

c. Accessory drive gear must also fit over seal ring on ground sleeve hub.

d. Output shaft must spline into turbine hub.

(Continued on next page)

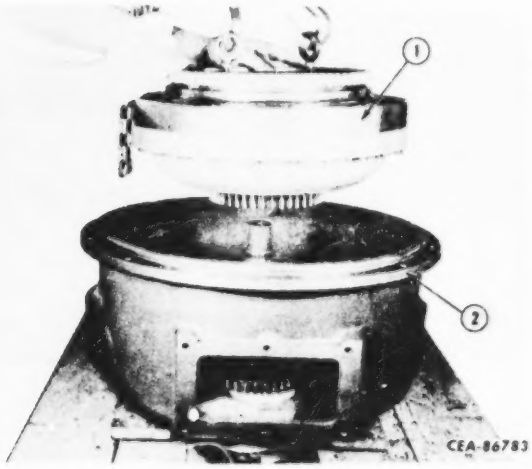


Figure 3-53

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY - Continued

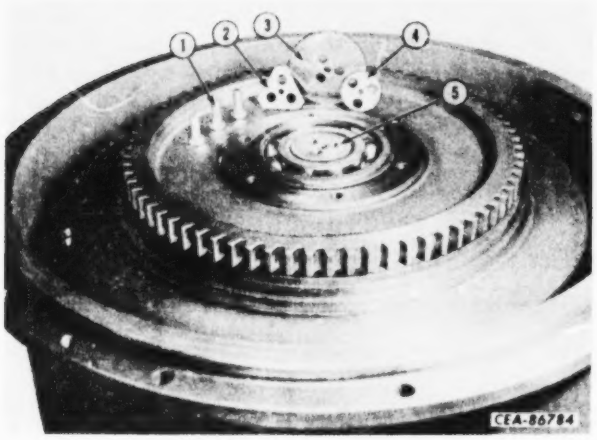


Figure 3-54

Place original shim pack (if any) (4, Fig. 3-54) on end of output shaft (5). Install retaining washer (3) with cap screws (1) and new locking plate (2). Tighten cap screws hand tight.

Using a feeler gauge (1, Fig. 3-55) measure clearance between lower surface of retaining washer and drive housing bearing inner race. Add or subtract shims beneath retaining washer until clearance between washer and bearing is within recommended limitations (refer to Fig. 3-57).

When proper clearance is obtained, tighten cap screws to recommended torque (refer to "SPECIAL TORQUES"). Bend up tabs on locking plate (1, Fig. 3-56).

Torque: _____

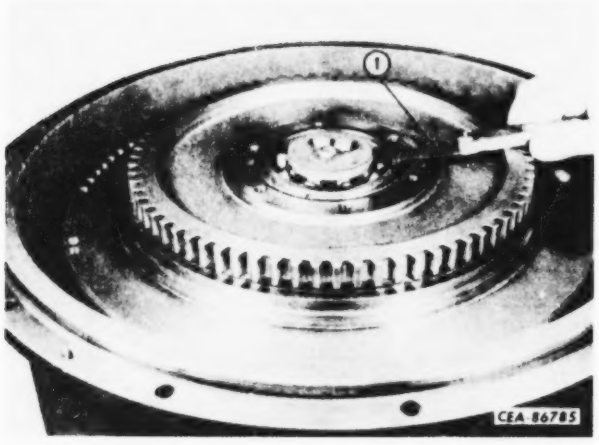


Figure 3-55

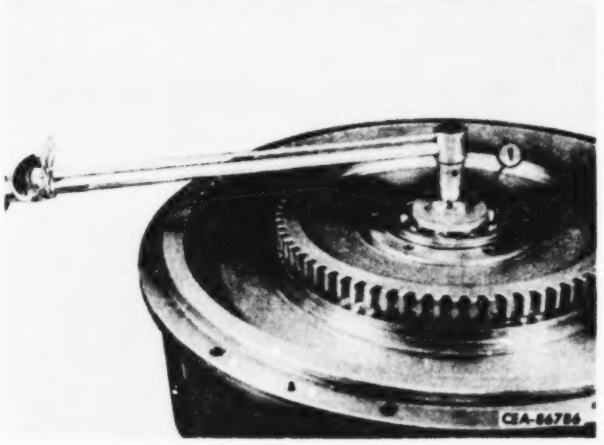


Figure 3-56



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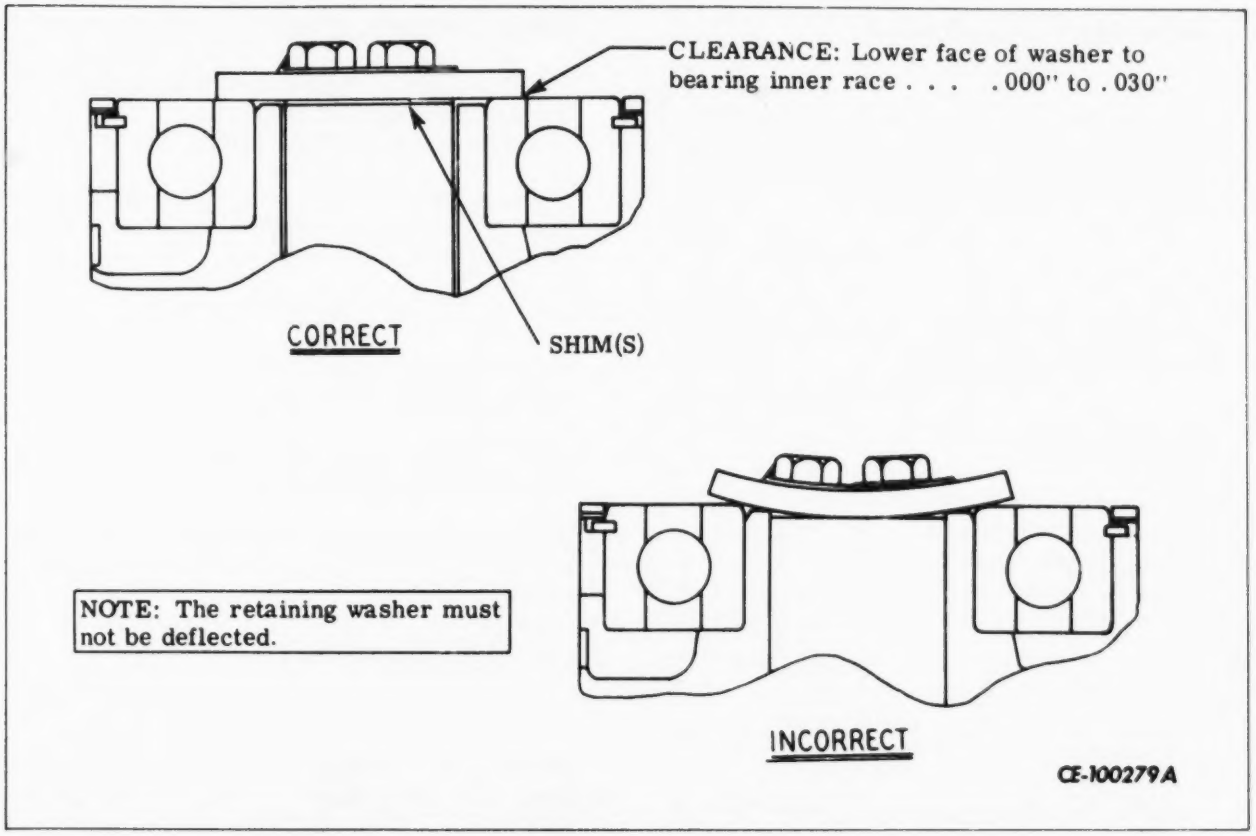
CLEARANCE: Lower face of washer to bearing inner race . . . .000" to .030"
CORRECT
SHIM(S)
NOTE: The retaining washer must not be deflected.
INCORRECT
CE-100279A

Figure 3-57

Place previously selected shim pack (1, Fig. 3-58) on outer race of drive housing bearing (2).

Install input hub (1, Fig. 3-59) and secure with cap screws (2) and lock washers. Tighten cap screws to the recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

(Continued on next page)

Figure 3-58

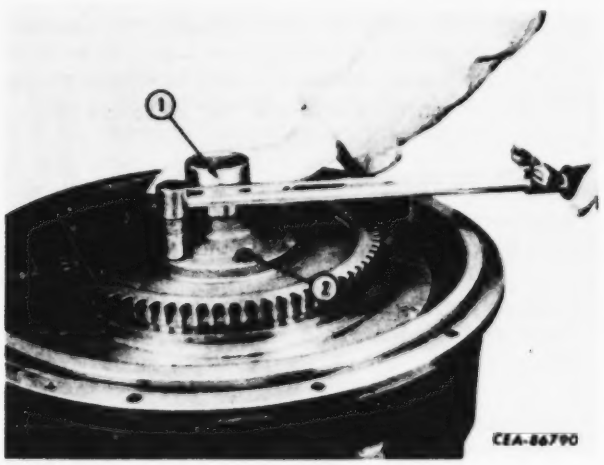


Figure 3-59

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY - Continued

Center a new gasket (1, Fig. 3-6) on pump inspection cover opening. Install inspection cover (2) and retain with cap screws and lock washers. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque:_____

Install new "O" ring (1, Fig. 3-5) in groove of converter housing (2).

### INSTALLATION

Support converter assembly with suitable sling and hoist and position it on engine flywheel housing. Install retaining cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Connect breather line to elbow at top of converter housing.

Connect electrical leads.

Install drive shaft between converter and transmission. Tighten retaining cap screws to recommended torque (refer to Section V, under "SPECIAL TORQUES").

Torque:_____

Connect all lines to hydraulic pumps and converter housing. Identification tags, attached to the lines during removal, will aid in this operation. Be sure to use new "O" rings at all split-flange type connections.

Position bulkhead assembly (1, Fig. 3-2) on tractor and secure with cap screws, lock washers and hex nuts. Tighten nuts securely.

Fasten front end of hood (2, Fig. 3-2) to bulkhead and tighten all hood fasteners, front and rear.

Connect tachometer drive.

Connect following lines:

Air cleaner restriction indicator.
Cold weather starting aid.
Transmission filter lines.

Connect reservoir-to-pump tubes (3, Fig. 3-3), reservoir-to-bracket tube (1) and reservoir-to-cooler hose (2) to reservoir.

Install all hood sides (3, Fig. 3-2).

Install battery cable clamps. Connect battery cables, ground cable last.

Fill hydraulic reservoir (refer to Section XI, "HYDRAULIC SYSTEM").

Add required fluid to transmission-converter system (refer to Section IV, "TRANSMISSION" for fill and check procedure).

### INPUT PUMP (EARLY TYPE)

#### DISASSEMBLY

Remove snap ring (1, Fig. 3-60) (where used) from drive gear shaft (7). Remove cap screws (11) and lock washers from pump assembly. Using a soft mallet tap on input drive gear and shaft (7) while holding pump body (5) to separate assembly. Remove pump base (2), pump idler gear (6), pump drive gear and shaft (7) and pump cover (10) from pump body (5). Using a suitable puller, remove needle bearings (4, 8) from pump base (2) and pump cover (10).

#### CLEANING AND INSPECTION

Clean all parts thoroughly in mineral spirits. Inspect pump body, base, cover and gears for excessive wear and/or scoring. Inspect needle bearings for wear, discoloration and/or fatigue.

#### ASSEMBLY

Assemble pump cover (10, Fig. 3-60) including needle bearings (8) to pump body (5). Align cover on dowels (9). Install drive gear and shaft (7) and idler gear (6). Assemble pump base (2) including needle bearings (4) to pump body (5).



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

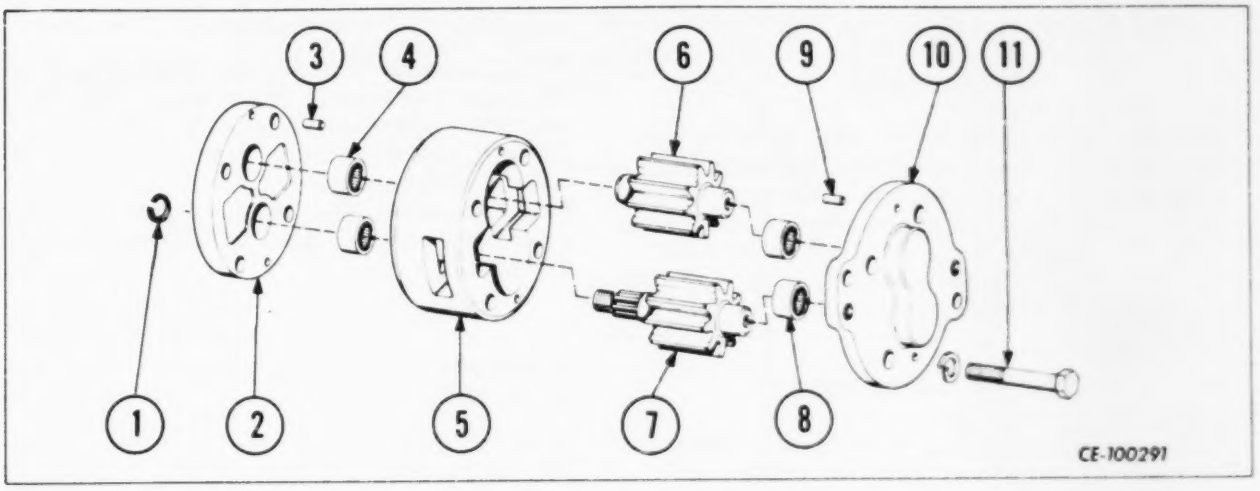


Figure 3-60
Input Pump (Early Type).

1. Snap ring.
2. Pump base.
3. Dowel pin.
4. Needle bearing.
5. Pump body.
6. Idler gear.
7. Input drive gear and shaft.
8. Needle bearing.
9. Dowel pin.
10. Pump cover.
11. Cap screw.

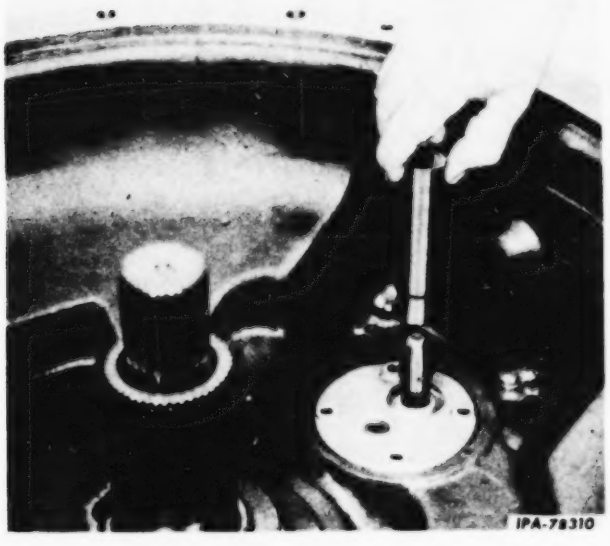


Figure 3-61

NOTE: Lubricate bearings (4, 8) and gears (6, 7) with a heavy weight motor oil during assembly.

Install cap screws (11) and lock washers in pump assembly. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque:_____

Rotate pump drive shaft to be sure gears and shafts turn freely.

If shaft was equipped with a snap ring (1), install a new snap ring using tool 1 020 449 R91. (I. H. Service Tool Manual ISS-1002-C.)

Install tool sleeve on pump shaft. Place a new snap ring on sleeve and using tool driver, slowly tap snap ring into groove on pump shaft (Fig. 3-61).

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### INPUT PUMP (LATE TYPE)

#### DISASSEMBLY

Remove cover assembly (7, Fig. 3-62) by removing socket head cap screws (8). Remove seal (6) from cover. Remove drive gear (10), driven gear (4), pins (5) and wear plate (3) from body (1). Remove seals (11) from wear plate. Using a suitable puller remove bushings (2 and 9) from body and cover.

#### CLEANING AND INSPECTION

Clean all parts thoroughly in solvent. Inspect pump body, cover and gears for excessive wear and/or scoring. Inspect bushings for wear. Replace any worn or defective parts. Replace all seals.

#### ASSEMBLY

Press bushings (2 and 9) into body (1) and cover (7). Install new seals (11) in wear plate (3). Install wear plate, driven gear (4), drive gear (10) and pins (5) in body. Install new seal (6) in cover and secure cover to body with socket head cap screws (8). Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

Rotate pump drive shaft to be sure gears and shafts turn freely.

Insert pump shaft in torque converter drive gear and secure with nut. Tighten lock nut to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

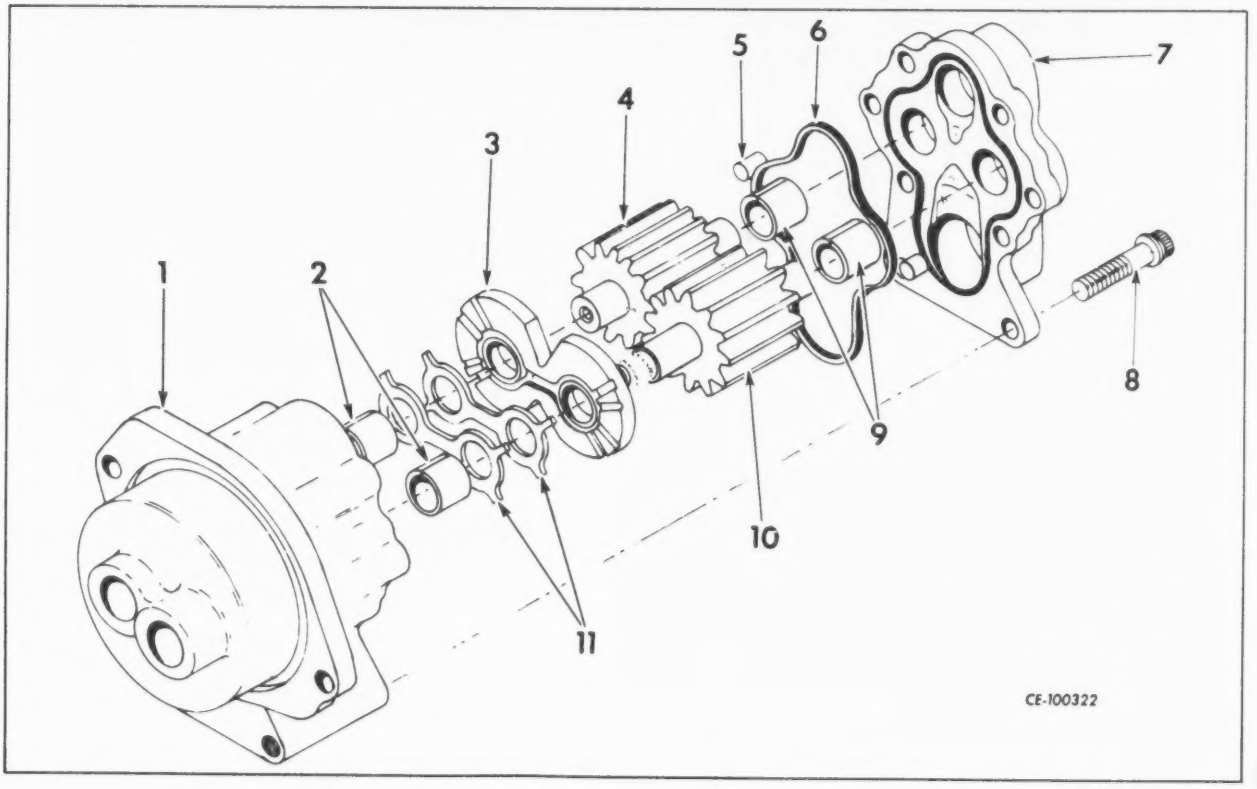


Figure 3-62
Input Pump (Late Type).

1. Body.
2. Bushings.
3. Wear plate.
4. Driven gear.
5. Pin.
6. Seal.
7. Cover assembly.
8. Socket head cap screws.
9. Bushings.
10. Drive gear.
11. Seals.



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## TROUBLE SHOOTING

Refer to Section IV, "TRANSMISSION TROUBLE SHOOTING."

## SERVICE INFORMATION

### SPECIFICATIONS

| | |
|---|---|
| Converter type | Single stage, single phase, three element |
| Torque multiplication at stall | 2.08:1 |
| Oil system: | |
| Type | Integral with transmission |
| Input pump: | |
| Type | Positive displacement, gear type |
| Capacity | 30 gpm at 2000 rpm and 200 psi |
| Oil pressure (charging pressure) | 50 - 100 psi at high idle |
| Oil temperature | 250°F. maximum |
| Oil filter | Full flow-remote mounted |
| Oil cooler | Remote mounted |

| | DT-817 | NT-855 |
|---|---|---|
| Converter stall speed | 2160 max. | 2125 max. |

### LUBRICANTS AND CAPACITIES

Refer to Section 4, "TRANSMISSION."

### SPECIAL TORQUES

| | |
|---|---|
| Input pump mounting cap screws | 26-32 ft. lbs. |
| Input pump drive gear retaining nut | 45-55 ft. lbs. |
| Output shaft bearing retainer cap screws | 26-32 ft. lbs. |
| Output yoke retainer washer cap screws | 26-32 ft. lbs. |
| Accessory drive gear-to-impeller cap screws: | |
| 5/16" cap screws | 36-43 ft. lbs. |
| 7/16" cap screws | 50-60 ft. lbs. w/Loctite. |
| Drive housing-to-impeller | 36-43 ft. lbs. |
| Retaining washer-output shaft to input drive bearing | 26-32 ft. lbs. |
| Input hub retaining cap screws | 26-32 ft. lbs. |
| Inspection cover retaining cap screws | 26-32 ft. lbs. |
| Input pump assembly cap screws (Early Type) | 26-32 ft. lbs. |
| Input pump cover cap screws (Late Type) | 28-32 ft. lbs. |

# TORQUE CONVERTER

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
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# SECTION IV
# TRANSMISSION

SECTION IV TRANSMISSION


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## GENERAL INFORMATION

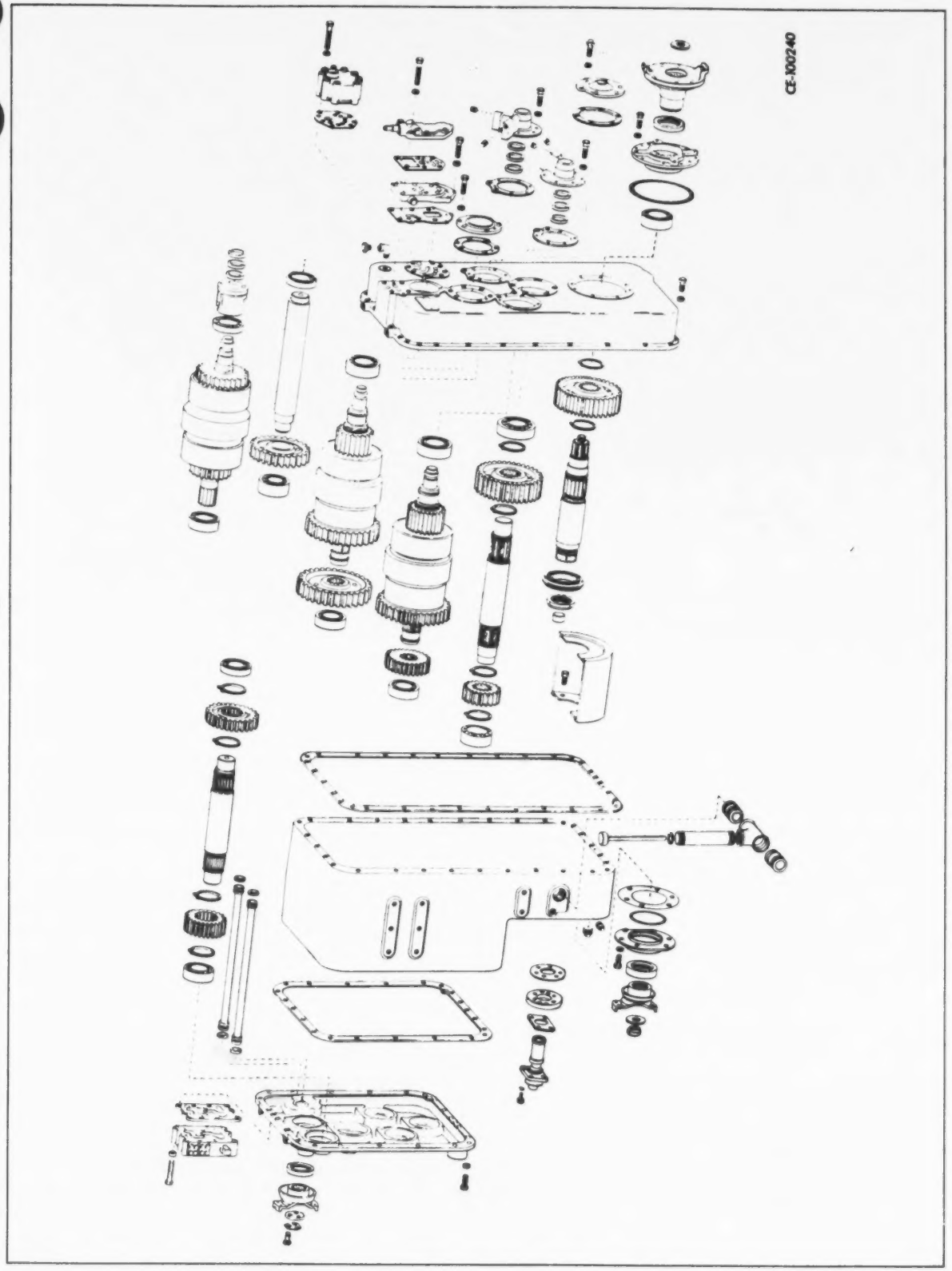


Figure 4-1
Exploded View of Transmission.

## GENERAL INFORMATION

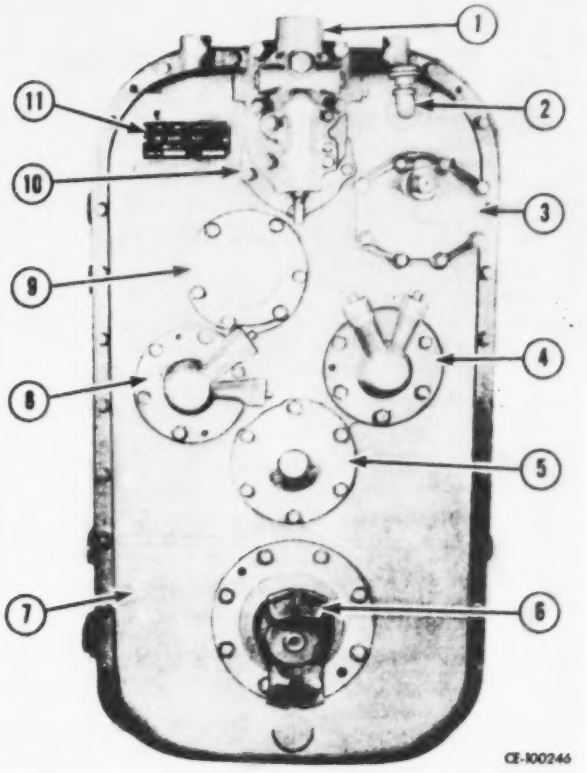


Figure 4-2
Front of Transmission.

1. Forward and reverse control valve.
2. Breather.
3. Range selector valve.
4. First and third oil supply cover.
5. Gather shaft bearing cover.
6. Front output yoke.
7. Front housing cover.
8. Second and fourth oil supply cover.
9. Idler shaft bearing cover.
10. Neutral knockdown valve.
11. Name plate.

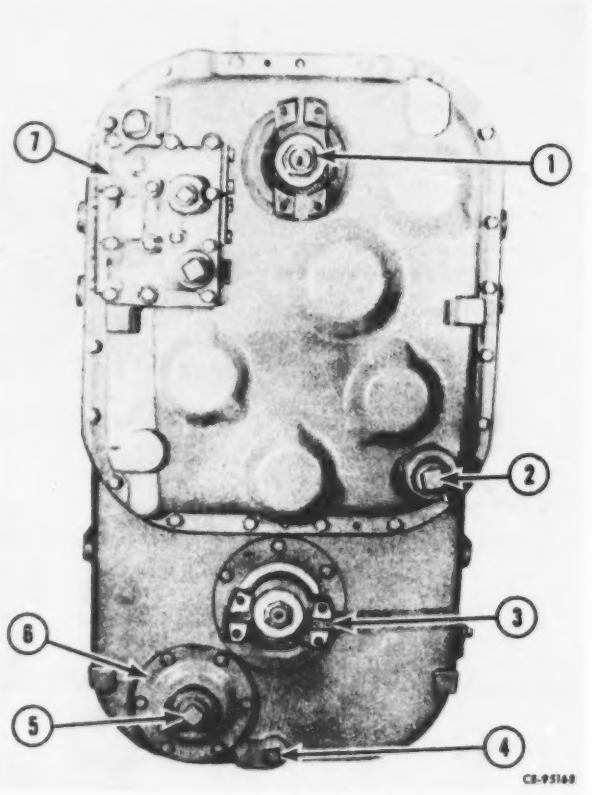


Figure 4-3
Rear of Transmission.

1. Input yoke.
2. Converter housing drain.
3. Output yoke.
4. Transmission drain.
5. Pump suction.
6. Sump oil screen.
7. Main regulator valve.

## DESCRIPTION

The full power shift transmission is designed to increase the useful range of the torque converter. A countershaft design with hydraulically actuated clutches is employed. First range increases power for starting and as the demand on the converter diminishes the transmission may be progressively shifted into higher ranges. The transmission incorporates gearing designed to take the extremely wide ranges and types of work performed in the construction industry.

The transmission has four speeds in both forward and reverse and full power shift in all ranges.

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## GENERAL INFORMATION

The transmission is of countershaft design. This design employs shafts parallel to, and driven by, the input shaft. Gears mounted on parallel shafts run free unless "clutched" to the shaft.

To assure smooth, high speed shifts, all clutches are mounted in pairs. Pairing the clutches affords compactness in design and hydraulic balance. The clutch design allows the transfer of oil from the disengaged clutch to the cavity created by the engaging clutch. Thus, a low volume of high pressure oil actuates the clutch for high speed shifting.

Only a small volume of oil is needed to fill the clutch cavity and pressurize the clutch. Large, high volume pumps are unnecessary in this design.

## PREVENTIVE MAINTENANCE

### OIL

For the recommended type and quantity of transmission lubricant refer to "LUBRICANTS AND CAPACITIES."

### CHANGE PERIODS

Oil change - 1000 hours of operation.

Clean transmission filter oil screen - 1000 hours of operation.

Change external filter - 500 hours of operation.

Change the oil and filter and clean the filter screen whenever traces of dirt or the effects of high operating temperatures are present as evidenced by discoloration or strong odors.

After any internal failure, change oil and completely flush and clean the converter and transmission including filter, lines, oil cooler and valve bodies. Failure to perform this service will result in additional failures through contamination.

Metal particles in the oil indicate a failed or wearing part and the entire system and units should be drained, flushed and thoroughly cleaned.

To drain the installation, remove the drain plug(s) in the bottom of the transmission housing.

### OIL LEVEL CHECK

Oil level should be checked daily or at the beginning of each shift.

NOTE: Tractor must be on level ground when checking oil level.

Pre-Start Check: Insure sufficient oil in the system before starting the engine. Remove dipstick from oil filler tube located on right side of transmission sump. Oil in transmission sump should be above "OPERATING RANGE" (top mark) on the dipstick. If not, add oil to level of top mark.

Hot Oil Check: With engine and transmission at normal operating temperature, transmission in neutral, and engine idling, oil in the transmission sump should be level with the "OPERATING RANGE" mark. For greatest accuracy, oil level check should be made with engine idling at 1000 rpm. If the oil is not level with the "OPERATING RANGE" mark, add oil to bring it to this level.

### OPERATING TEMPERATURE

Normal operating temperature - refer to "OPERATING RANGES."

Maximum operating temperature - refer to "OPERATING RANGES."

(Continued on next page)

## PREVENTIVE MAINTENANCE

### OPERATING TEMPERATURE - Continued

The operating temperature of the oil is registered as oil leaves the converter and is read on the temperature gauge on the vehicle dash. Converter "OUT" temperature check point (1, Fig. 4-4) is located in the converter-to-cooler line.

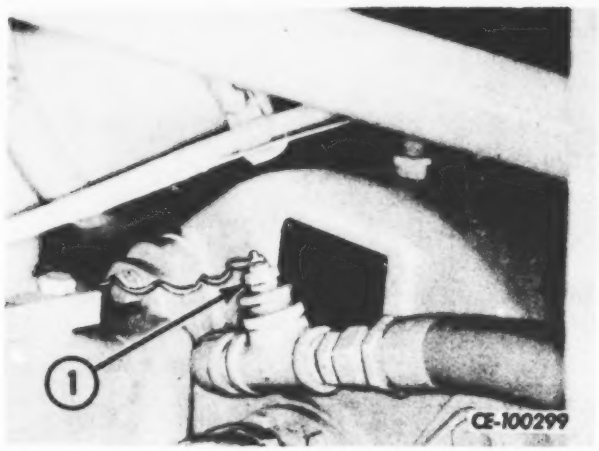


Figure 4-4
Converter "Out" Temperature Check Point.

To cool the oil, shift transmission into neutral, apply parking brake and accelerate engine to 1000 to 1500 rpm. The temperature of the oil should drop to a safe operating range.

### OPERATING PRESSURES

Pressure checks should be made with engine and transmission at normal operating temperature. Transmission oil temperature should approximate minimum engine water temperature (refer to "OPERATING RANGES").

Pressure checks should be made at full power stall.

Clutch Pressure at Stall:

a. Refer to "OPERATING RANGES" for clutch pressure limitations.

b. Pressure may be read on dash gauge.

c. Service gauge may be attached to clutch pressure tap (1, Fig. 4-5), on main regulator valve body.

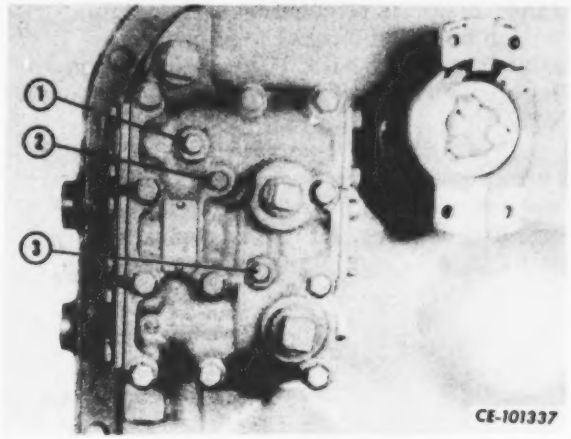


Figure 4-5
Main Regulator Valve Pressure Tap Points.

1. Clutch pressure
2. Converter charging pressure
3. Lube pressure

Converter Charging Pressure at High Idle:

a. Refer to "OPERATING RANGES" for charging pressure limitations.

b. Service gauge may be attached to converter charging pressure tap (2, Fig. 4-5) on main regulator valve body.

Lube Pressure (High Idle):

a. Refer to "OPERATING RANGES" for lube pressure limitations.

b. Service gauge may be attached to lube pressure tap (3, Fig. 4-5), on main regulator valve body.

### STALL CHECK

A full power stall check is made to determine whether or not the engine has rated power and if converter and transmission are operating correctly.



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## PREVENTIVE MAINTENANCE

### LINKAGE ADJUSTMENTS

Both range and directional linkage must be adjusted to allow free movement and a definite "Detent" feel as the lever is moved from one position to another. Linkage should not bind or hold valves or levers between "Detent" position.

NOTE: Never position between detents.

Refer to Section IX, "LINKAGE" for correct adjustment procedure.

### EXTERNAL LINES

All external lines should be inspected periodically for:

Loose fittings that allow oil or air leaks.

Damaged, collapsed or worn hose.

### WIRING

All wiring should be inspected periodically for loose connections and broken or damaged wires. Tape all frayed insulation.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### PREPARATION

Disassembly preparation should include:

Disconnecting all external lines from transmission housing.

Provisions for steam cleaning transmission and surrounding area. Do not use caustic soda.

Preparing a dirt-free work area at least 12 ft. square.

A suitable hoist.

The following tools:

Low table or bench for disassembly.

Shop press.

Hydraulic gear and bearing puller set, rated at a minimum of 17 tons.

Mechanical gear and bearing puller set.

Solvent for cleaning parts.

Standard set of mechanics hand tools including:

Snap ring pliers
Brake spring pliers
Torque wrench - 100 ft. lb. capacity.
Mallet (preferably plastic)

Special lifting tool (refer to Section VI, "SPECIAL TOOLS").

Snap ring groove filler (refer to Section VI, "SPECIAL TOOLS").

Pans for holding small parts during disassembly.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### REMOVAL

Drain transmission fluid.

Remove cap screws (1, 2, Fig. 4-6) that secure ladder and hand rail to front frame and operator's compartment; remove ladder.

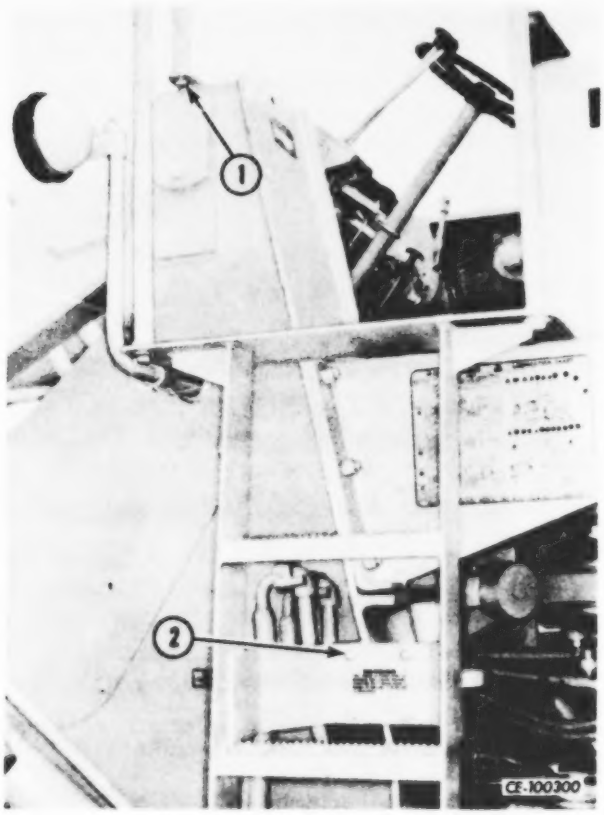


Figure 4-6

Remove cotter pins and pins (3, Fig. 4-7) that connect hydraulic control valve levers (1) to control rods (2). Unbolt bracket (4) from rear floorboard (5).

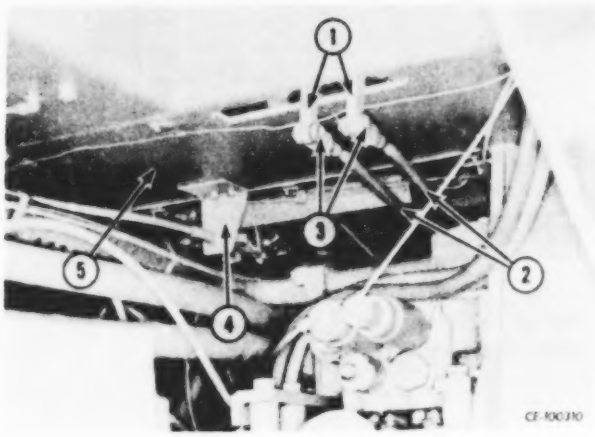


Figure 4-7

Remove cap screws (1, Fig. 4-8) that secure rear floorboards (2) to operator's compartment and front floorboard. Remove floorboards.

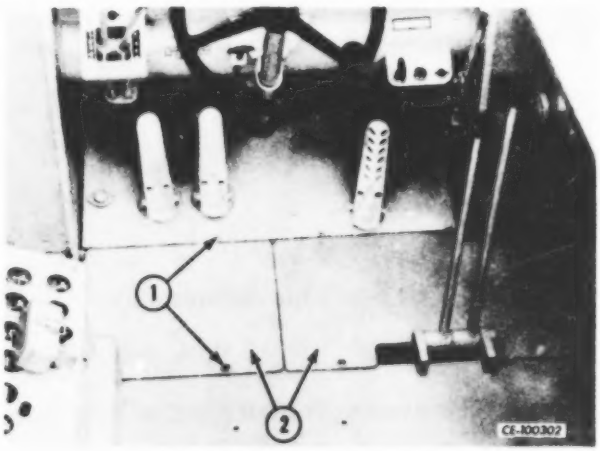


Figure 4-8

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Support operator's compartment with a sling and hoist. Remove cap screws and nuts (3, Fig. 4-9) that mount the operator's compartment (1) to the front frame (2). Remove operator's compartment.

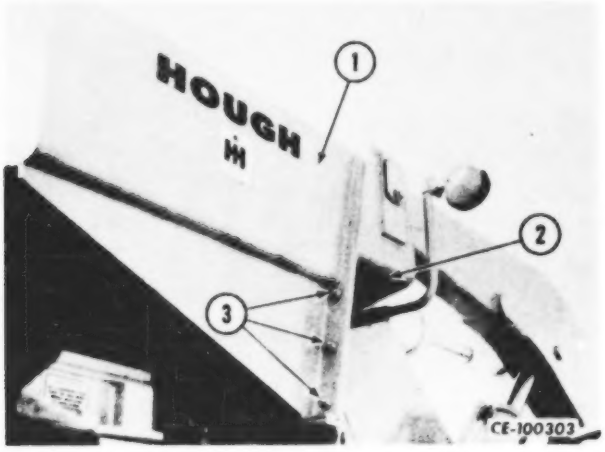


Figure 4-9

Disconnect transmission-to-parking brake drive shaft (3, Fig. 4-10) from transmission (4). Disconnect magnetic sensor (5) (where used) from transmission. Disconnect transmission linkage (1) from bellcrank (2).

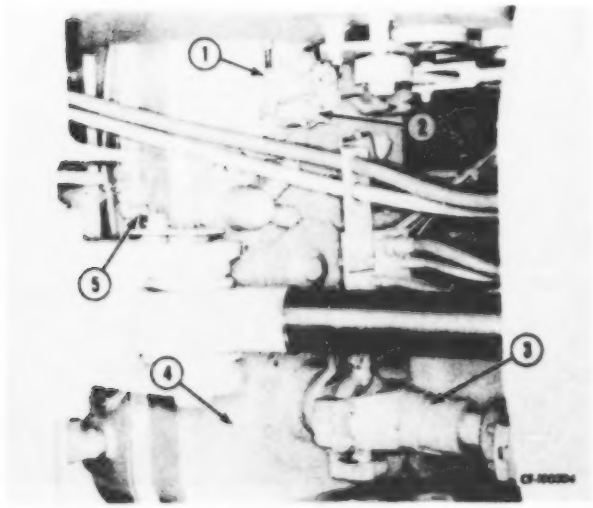


Figure 4-10

Disconnect transmission to rear axle drive shaft (1, Fig. 4-11) from transmission (4). Disconconect sump hose (2) and strainer hose (3).

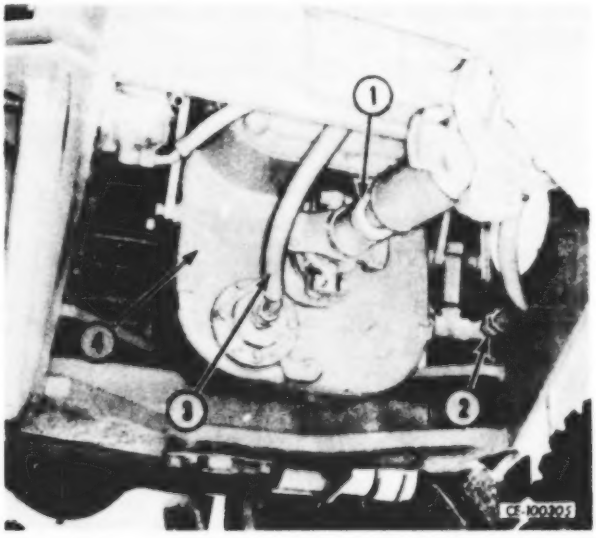


Figure 4-11

Drain hydraulic reservoir.

Disconnect pump-to-valve hose (4, Fig. 4-12), valve-to-loader valve hose (7) and valve-to-steering valve hose (5) at demand valve (6). Disconnect reservoir-to-loader valve hoses (1 and 3) from bracket (2).

(Continued on next page)

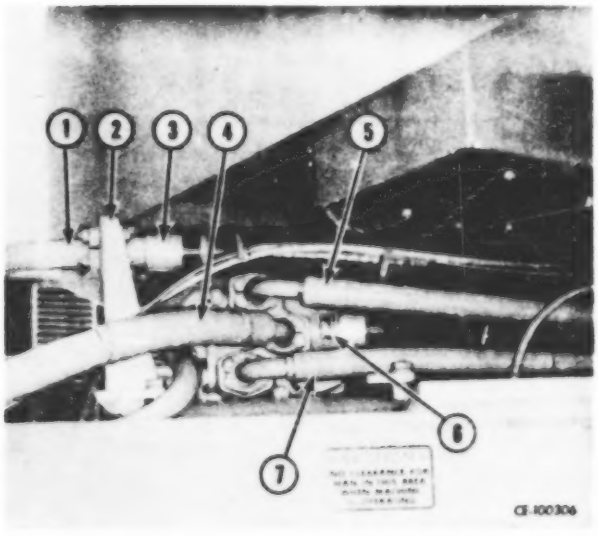


Figure 4-12

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### REMOVAL - Continued

Disconnect transmission to torque converter drive shaft (1, Fig. 4-13) from transmission. Disconnect any hoses leading to the transmission.

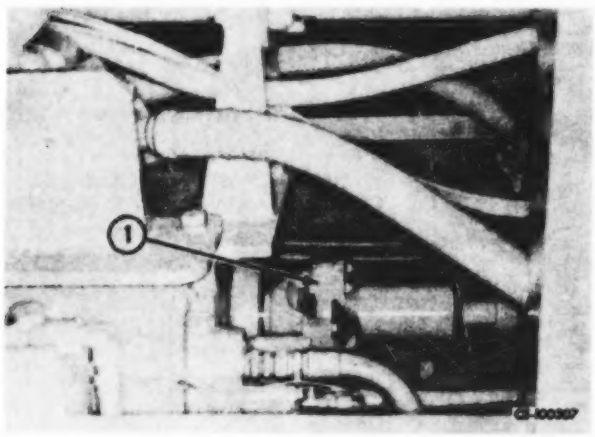


Figure 4-13

Remove demand valve (1, Fig. 4-14) from bracket. Remove brackets (2) from transmission.

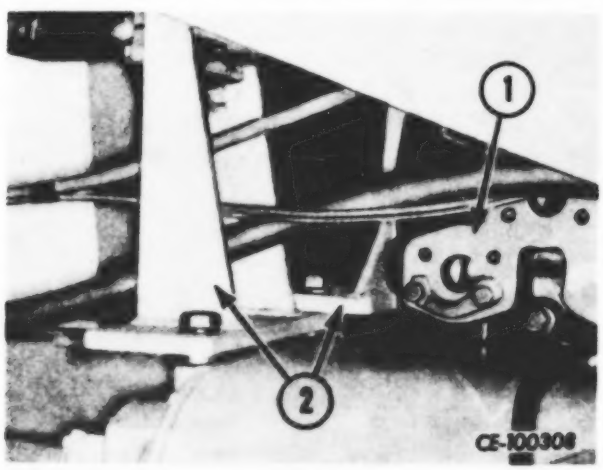


Figure 4-14

Install special lifting eyes (refer to "SPECIAL TOOLS") in holes on top of transmission. Attach chain to lifting eyes and take up slack.

Disconnect left hand and right hand transmission mounts (1, Fig. 4-15) and lower transmission from tractor. Move to disassembly area and remove transmission mounts.

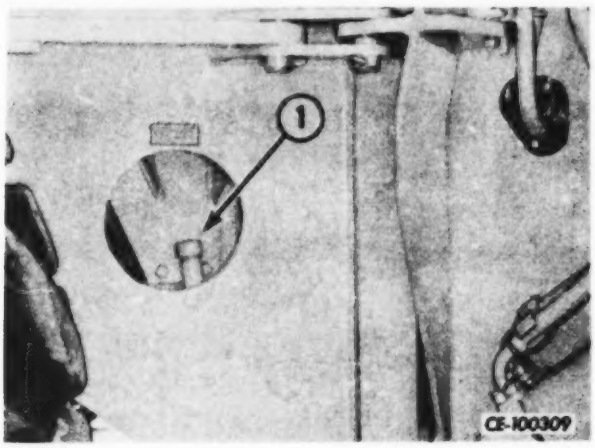


Figure 4-15

### DISASSEMBLY

Clean exterior of transmission and surrounding area thoroughly with plain steam (no caustic soda). Use a clean work area. Cleanliness is very important during transmission overhaul.

Be sure transmission is thoroughly drained.

Remove cap screws and lock washers that retain main regulator valve (1, Fig. 4-16). Remove valve and gasket (2). Discard gasket.

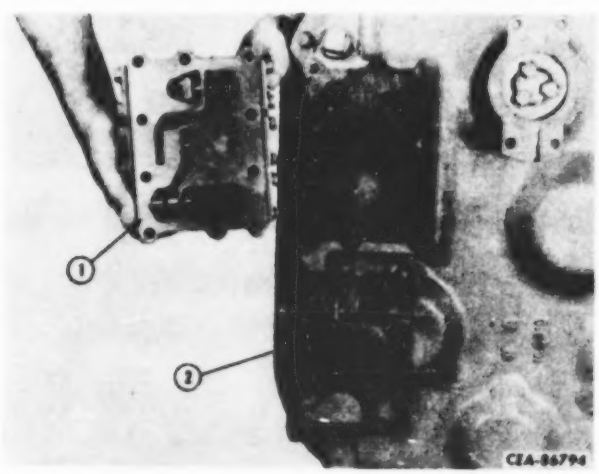


Figure 4-16

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Unlock and remove input yoke retaining cap screws (1, Fig. 4-17), locking plate (2), retaining washer (3) and yoke (4).

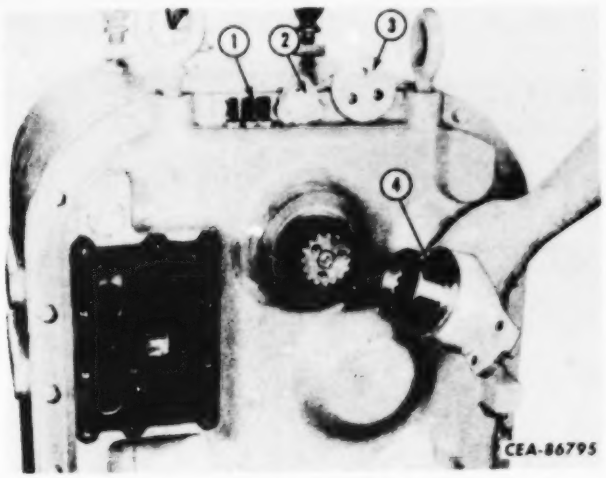


Figure 4-17

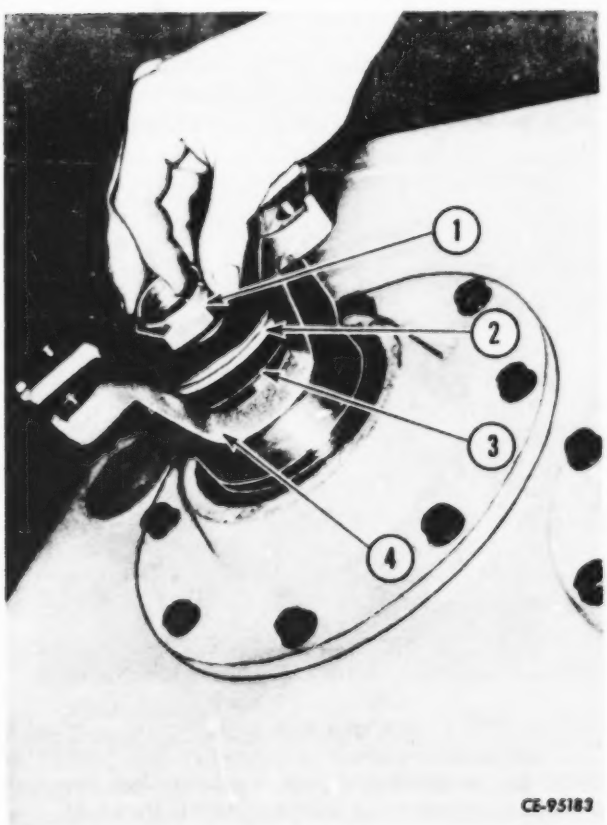


Figure 4-18

Remove output yoke lock nut (1, Fig. 4-18), washer (2) and "O" ring (3). Slide yoke (4) off output shaft.

Remove output shaft retainer cap screws. Use two of these cap screws (2, Fig. 4-19) in jackscrew holes to remove retainer (1) with "O" ring. Discard "O" ring.

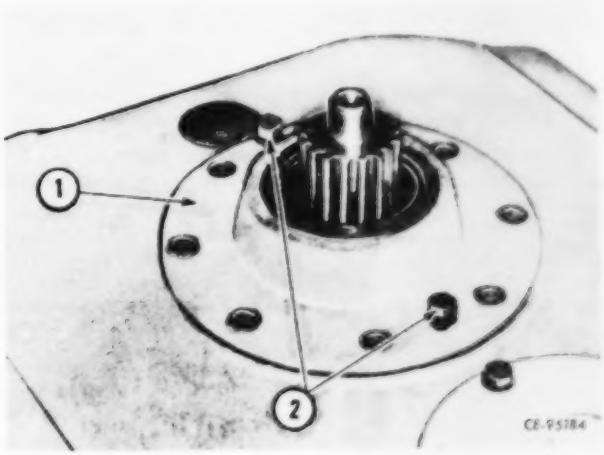


Figure 4-19

Remove cap screws (1, Fig. 4-20) and lock washers that secure oil supply covers (2). Insert two of these retaining cap screws in threaded jackscrew holes (4) provided in covers. Tighten jackscrews evenly to remove

(Continued on next page)

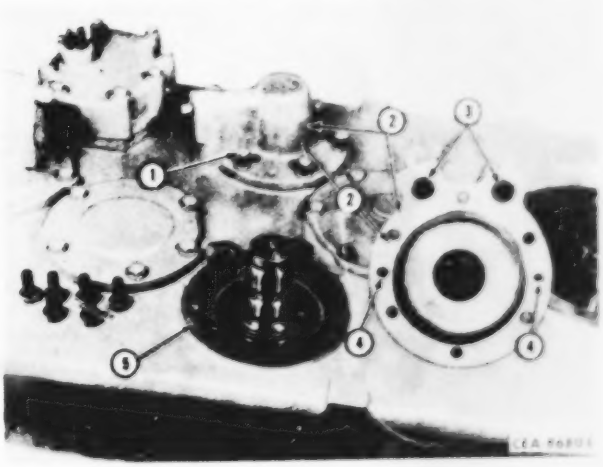


Figure 4-20

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DISASSEMBLY -Continued

supply covers. Discard cover gaskets (5) and "O" ring seals (3).

Remove cap screws lock washers and gather shaft bearing retainer (3, Fig. 4-21) with gasket (2). Discard gasket.

Repeat above process to remove main idler shaft bearing retainer (1).

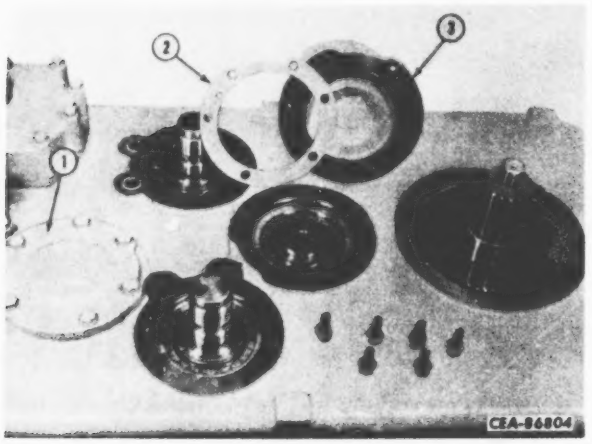


Figure 4-21

Remove cap screws (3, Fig. 4-22) and lock washers that secure directional selector valve (1). Remove valve and gasket (2). Discard gasket.

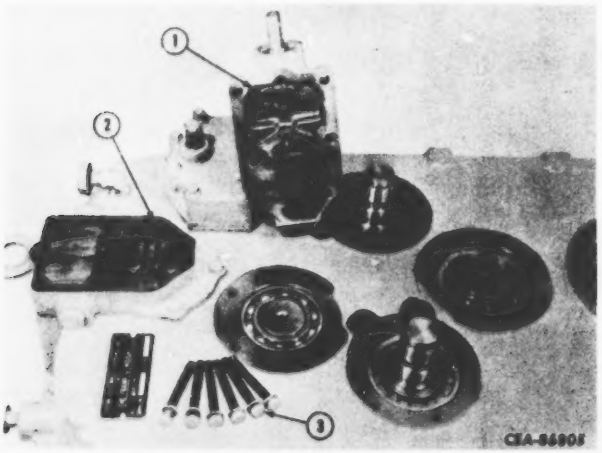


Figure 4-22

Remove cap screws that secure neutral knockdown valve (1, Fig. 4-23) to transmission rear cover (3). Remove valve and gasket (2). Discard gasket.

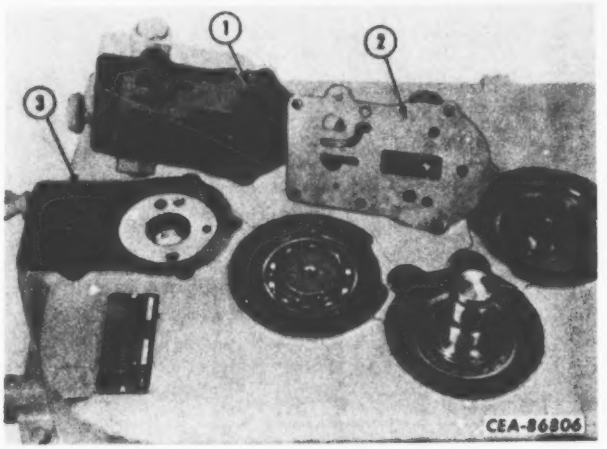


Figure 4-23

Remove cap screws that secure range selector valve (2, Fig. 4-24) to transmission rear cover (1). Remove valve and gasket (3). Discard gasket.

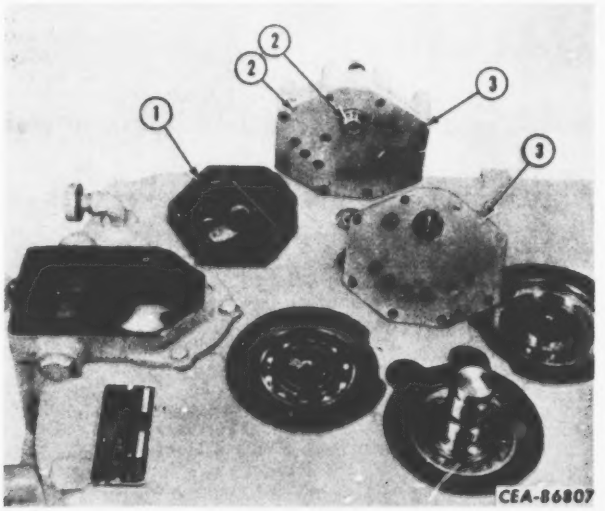


Figure 4-24

Remove cap screws and lock washers that retain transmission rear cover. Install three of these retaining cap screws in threaded jackscrew holes provided in cover. Tighten jack-

## DISASSEMBLY, INSPECTION AND ASSEMBLY

screws (1, Fig. 4-25) evenly to lift cover (2) from dowels (3) in transmission housing.

Attach a suitable sling and hoist and remove rear cover. Discard gasket.

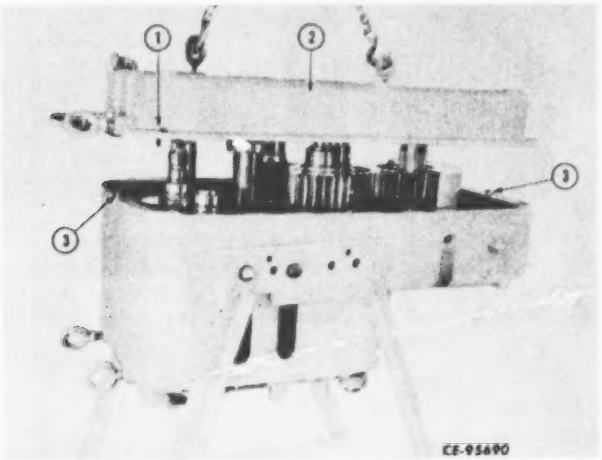


Figure 4-25

Remove oil transfer tubes (2, Fig. 4-26). Discard "O" ring seals (1) from both ends of tubes.

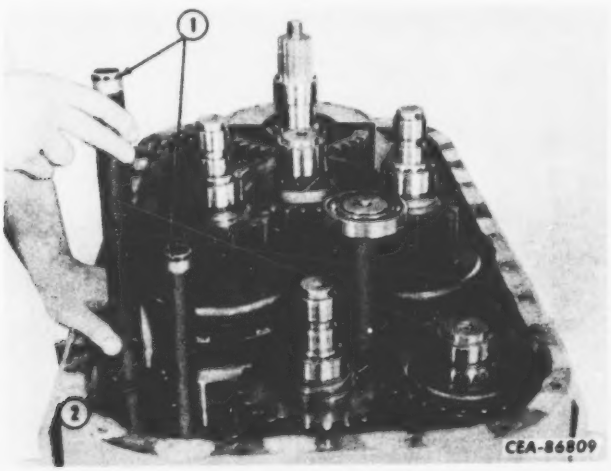


Figure 4-26

Attach special lifting tool (2, Fig. 4-27) (refer to "SPECIAL TOOLS") to forward-reverse clutch pack (3) in oil supply groove. Using a suitable hoist, lift clutch pack. Reverse idler shaft assembly (1) must be lifted out with clutch pack. For overhaul procedure refer to "CLUTCH PACKS."

NOTE: Do not attempt to lift clutch packs by oil supply ports. Serious damage may result.

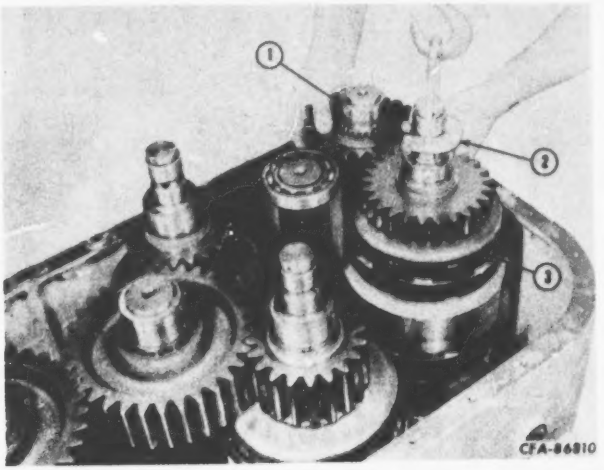


Figure 4-27

Remove gather shaft assembly (1, Fig. 4-28) by grasping low speed gather gear (2), lifting and cocking it slightly toward bottom of transmission.

(Continued on next page)

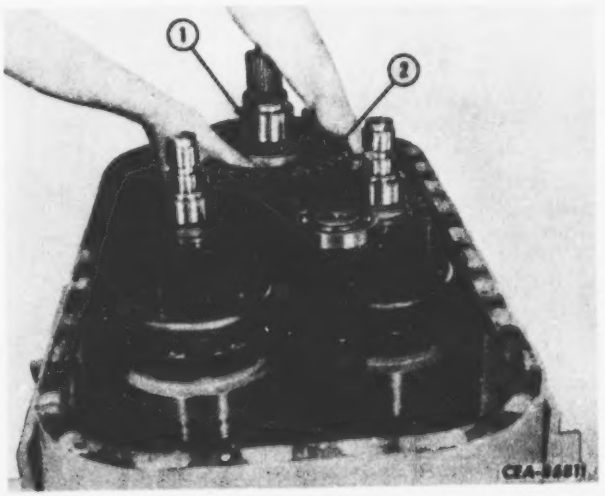


Figure 4-28

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DISASSEMBLY - Continued

Attach special lifting tool (1, Fig. 4-29) to 2nd-4th clutch pack (2) oil supply groove and remove clutch pack with hoist. For overhaul procedure refer to "CLUTCH PACKS."

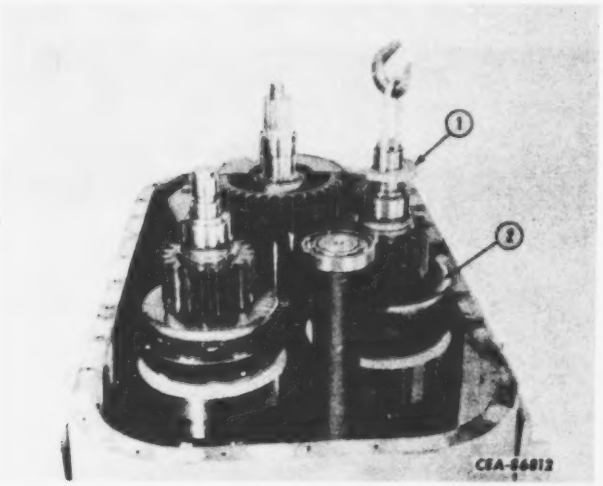


Figure 4-29

Attach special lifting tool (2, Fig. 4-30) to 1st-3rd clutch pack oil supply groove and remove clutch pack (1) with hoist. For overhaul procedure refer to "CLUTCH PACKS."

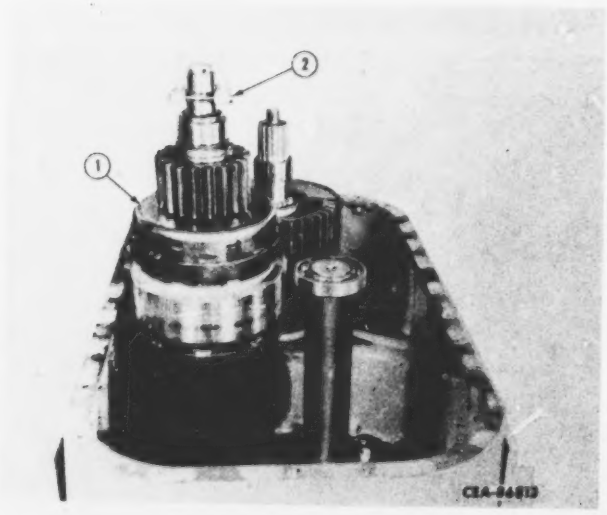


Figure 4-30

Pull straight up to remove main idler shaft (1, Fig. 4-31).

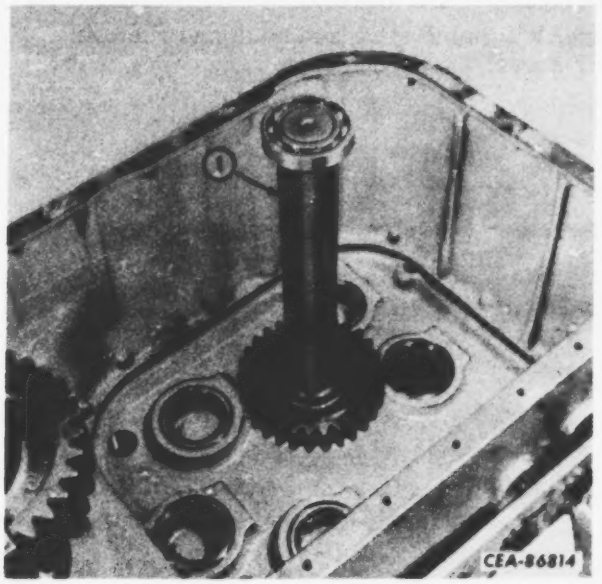


Figure 4-31

Remove Ny-lock retaining cap screws (2, Fig. 4-32) and oil baffle (1).

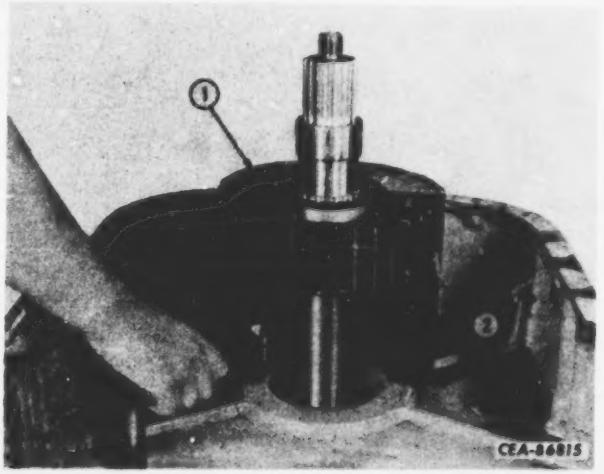


Figure 4-32

Secure transmission housing in a vertical position. Remove stop nut (4, Fig. 4-33), retainer (2), gasket (1) and yoke (3).

## DISASSEMBLY, INSPECTION AND ASSEMBLY

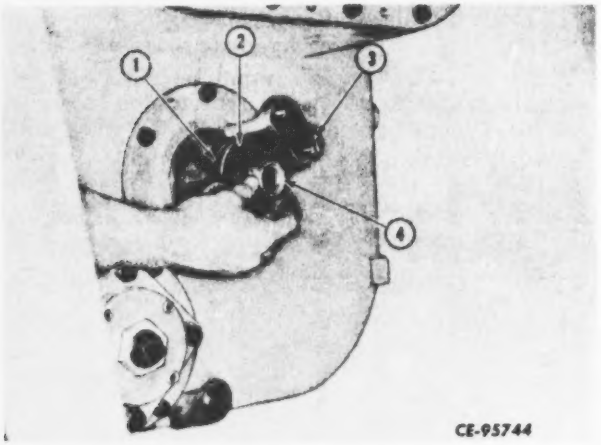


Figure 4-33

Remove cap screws that secure bearing retainer (2, Fig. 4-34) to housing (3). Use two of these cap screws in jackscrew holes (1) provided to remove retainer. Remove and retain the shim pack for reuse during assembly.

NOTE: Care must be taken to prevent dropping output shaft.

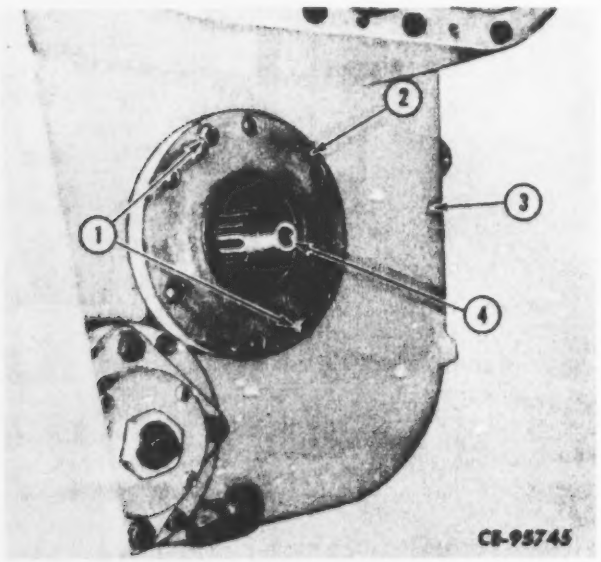


Figure 4-34

Remove output shaft (4) from housing.

Remove attaching cap screws (1, Fig. 4-35) and washers. Remove filter assembly (2) and discard gasket.

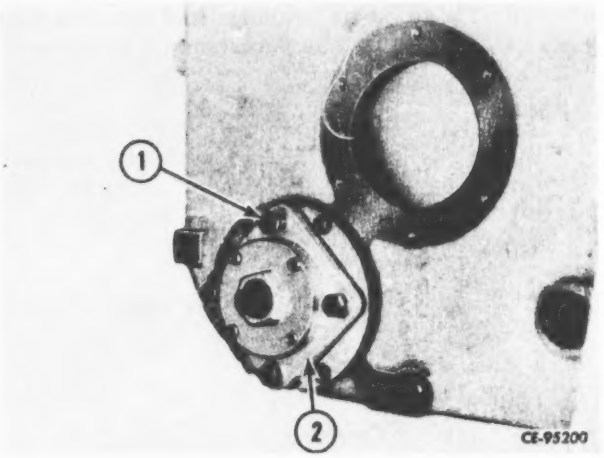


Figure 4-35

Rotate transmission until front cover is up.

Remove attaching cap screws and install two in jackscrew holes (1, Fig. 4-36) provided in front cover. Pry cover (2) from dowels (4) by rotating jackscrews equally. Remove and discard gasket (3).

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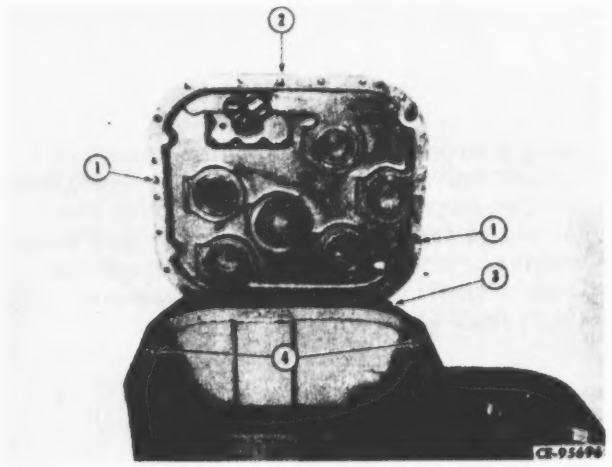


Figure 4-36

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DISASSEMBLY - Continued

Remove bearings (1, Fig. 4-37) and spacers (4) with an acceptable puller that will exert its pressure on outer bearing race only.

NOTE: These cover bearings and spacers need not be removed unless replacement is deemed necessary.

If cover (2) is to be replaced and bearings reused, tie bearing and spacer sets together and identify them with a tag. Reused bearings must be matched with their original shafts during assembly.

Remove input shaft seal (3) from cover (2) bore. Discard seal.

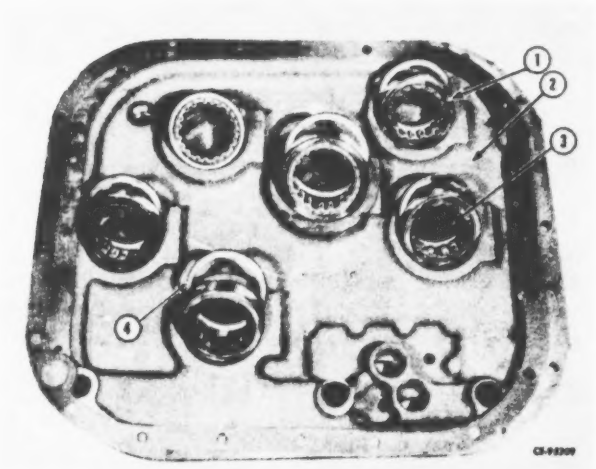


Figure 4-37

Using a suitable hydraulic puller and adapter, remove bearing inner race (1, Fig. 4-38) from reverse idler shaft. Remove retaining rings (2, 8) and driven gear (3). Using proper puller adapter, remove drive gear (7) and bearing inner race (9) together. Remove retaining rings (4, 6) from shaft (5).

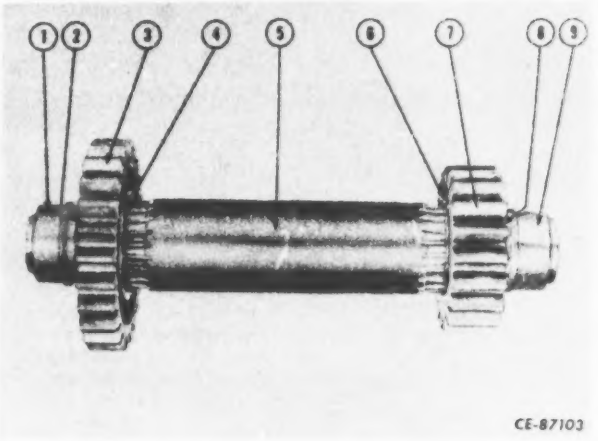


Figure 4-38

Using a suitable hydraulic puller and adapter, remove bearing inner race (1, Fig. 4-39), spacer (2) and gear (3) as a unit from gather shaft. Remove spacer (4). Remove retaining ring (8). Using the proper puller adapter, remove gear (7) and inner bearing race (9) together. Remove retaining ring (6) from shaft (5).

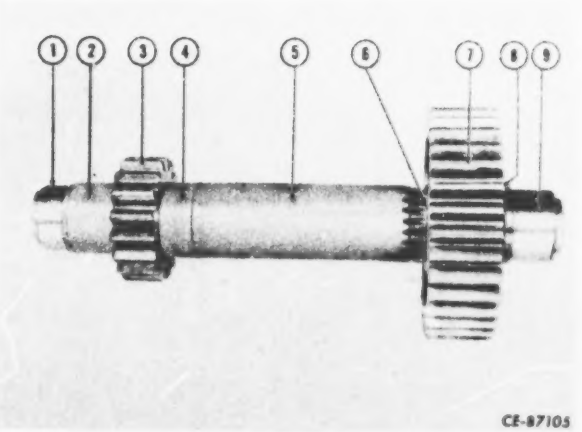


Figure 4-39

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Using hydraulic puller and adapter, remove the main idler gear (3, Fig. 4-40) and bearing inner race (4) from main idler shaft. Remove spacer (5) from shaft (2). Use puller holes provided in idler gear. With a suitable puller adapter remove bearing (1) from shaft.

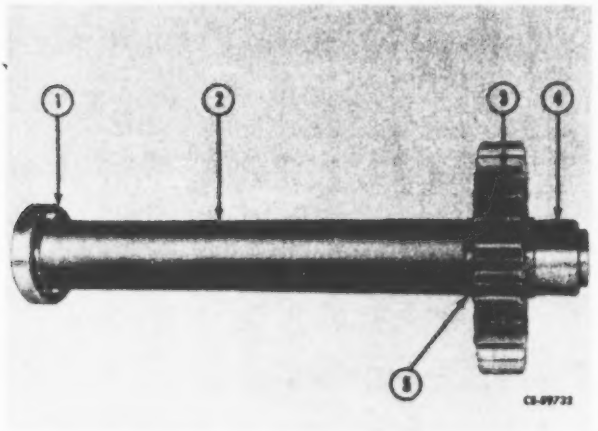


Figure 4-40

Using a puller, remove bearings (1, 3, Fig. 4-41) from output shaft (2). Remove snap ring (5) and gear (4).

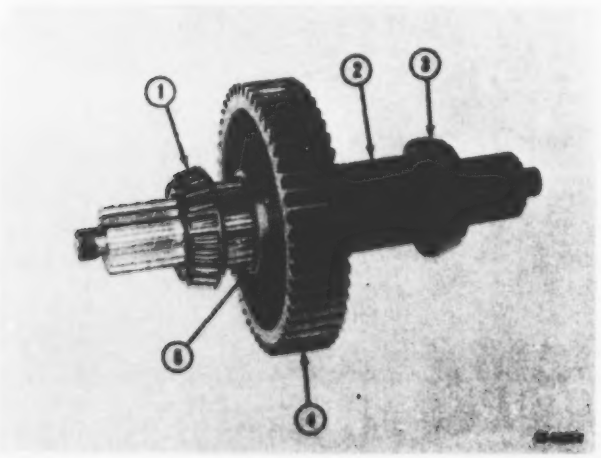


Figure 4-41

Prior to removal mark location of oil supply cover (2, Fig. 4-42) in rear cover (1) as an aid during assembly. Use a drift to remove supply cover from rear cover.

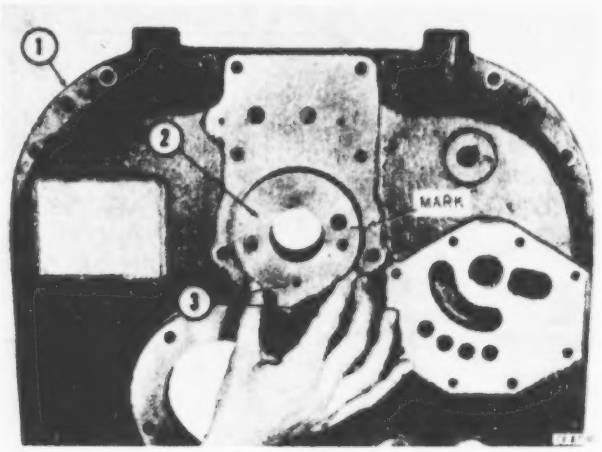


Figure 4-42

With a sharp instrument, pierce and remove seal rings (1, Fig. 4-43) from oil supply cover (2).

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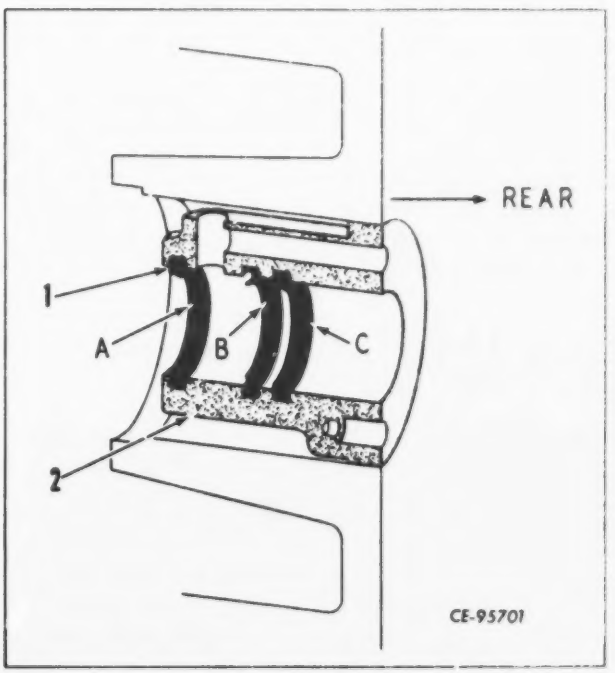


Figure -43

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DISASSEMBLY - Continued

Remove "O" rings (1, Fig. 4-44) from inlet port. Pierce seal rings (3) with a sharp instrument and remove rings from oil supply cover (2).

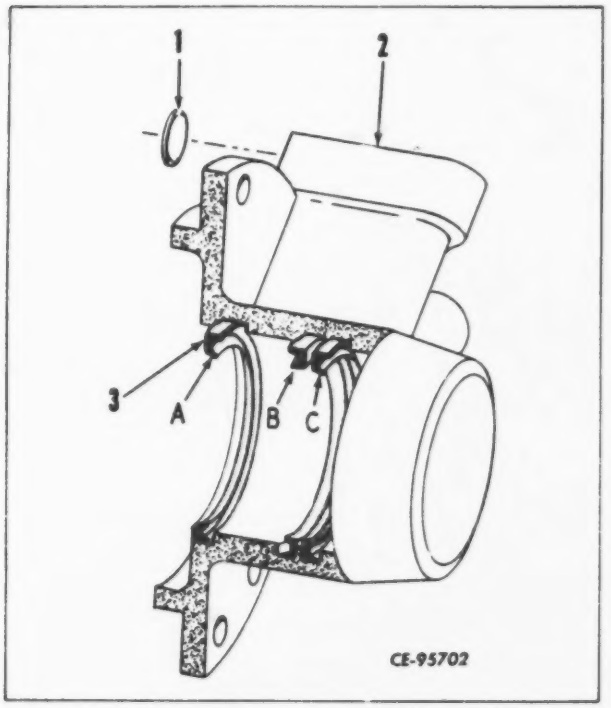


Figure 4-44

If removal of one or all of the bearings is required, use a soft drift to drive bearing from cover. (Fig. 4-45.)

NOTE: Drive on bearing outer race only.

Remove cap screws (1, Fig. 4-46) and flange (3) from valve housing (4). Unscrew filter element (5) from housing. Check operation of valve. Discard "O" ring (2).

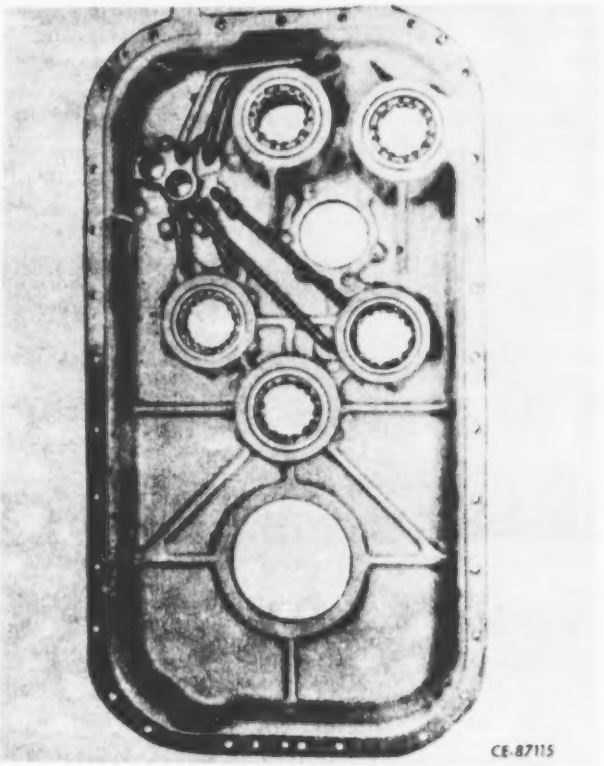


Figure 4-45

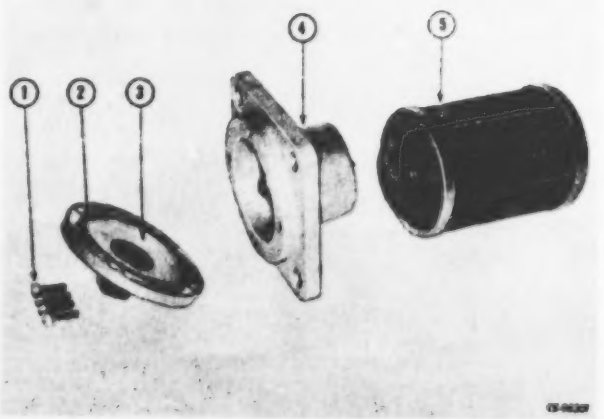


Figure 4-46

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove and discard output shaft front seal (2, Fig. 4-47) from bearing retainer (3). After inspection, bearing cup (1) may be removed if replacement is required.

NOTE: If replacement is required, bearing cup and cone must be replaced as a set.

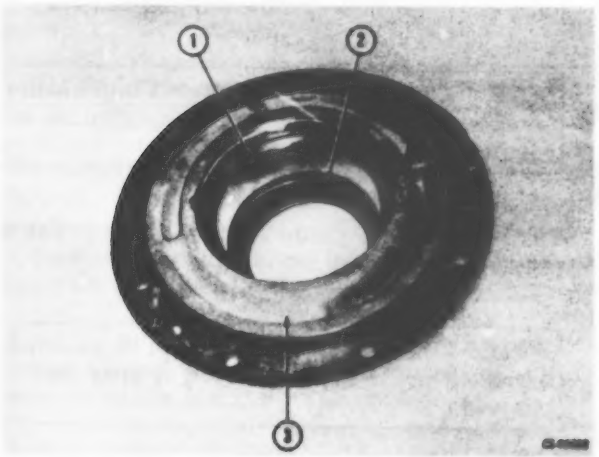


Figure 4-47

Remove and discard output shaft rear seal (2, Fig. 4-48) from bearing retainer (3). After inspection, bearing cup may be removed if replacement is required.

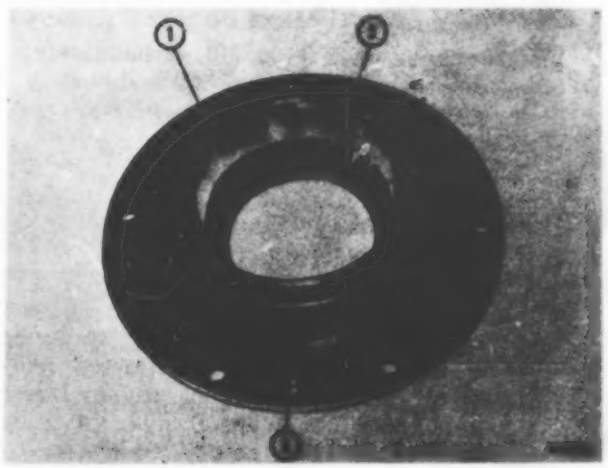


Figure 4-48

NOTE: If replacement is required, bearing cup and cone must be replaced as a set.

### CLEANING AND INSPECTION

Cleaning and inspection of the transmission in preparation for assembly should include the following:

a. Cleaning all parts thoroughly in solvent or plain steam. (Do not use caustic soda.) Use compressed air to dry parts. If steam is used to clean parts, oil immediately thereafter. Carefully inspect all parts for excessive wear, cracks and for breakage.

b. Inspecting all bearings for pits and spalled areas. Replace all damaged parts.

c. Replacing all seals, hook type seal rings, gaskets, "O" rings and snap rings.

d. Inspecting all sealing surfaces for wear and for grooving.

e. Inspecting housing for dirt particles, and flushing all passageways thoroughly.

f. Inspecting splines on all shafts and drive gears for wear.

g. Provisions should be made for heating bearings in oil or an oven.

h. Clean and flush oil supply tubes.

NOTE: Special Torque, Pressure, etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY

Coat O. D. of a new output shaft seal (2, Fig. 4-47) with "Mar-Seal" or equivalent sealant and press seal into output shaft front bearing retainer (3). Large, spring reinforced lip of seal should face in toward bearing cup (1). Press seal flush with outer edge of retainer.

If bearing cup was removed, press in a new cup. Cup must bottom on shoulder in retainer bore about its entire circumference.

Coat O. D. of a new output shaft seal (2, Fig. 4-48) with "Mar-Seal" or equivalent sealant and press seal into output shaft rear bearing retainer (3). Large, spring reinforced lip of seal must face in toward bearing cup (1).

If bearing cup was removed, press in a new cup. Cup must bottom on shoulder in retainer bore about its entire circumference.

Screw a new filter element (5, Fig. 4-46) into valve assembly (4). Position a new "O" ring (2) in flange (3) and attach flange to valve assembly with cap screws (1) and lock washers.

Bearings are a light drive fit. To install, use a soft drift or mallet and drive bearings into bearing bore (Fig. 4-45).

Install seal rings (3, Fig. 4-44), starting from rear of oil supply covers (2) as follows:

(c) Lips facing rearward.
(b) Lips facing forward.
(a) Lips facing rearward.

Coat lips of seal rings with grease. Install new "O" rings (1) in inlet ports. Retain "O" rings in position with small amount of grease.

Install seal rings (1, Fig. 4-43) in oil supply cover (2) starting from rear of cover.

(a) Lips facing rearward.
(b) Lips facing forward.
(c) Lips facing rearward.

Coat lips of seal rings with grease.

To install oil supply cover (2, Fig. 4-42) align identification marks and using a mallet, drive supply cover into bore in front cover (1). If replacement of oil supply cover or front cover is required, align lube hole in oil supply cover with cap screw hole (3).

Press bearing (3, Fig. 4-41) on output shaft (2). Install gear (4) on shaft and secure with snap ring (5). Press on the remaining bearing.

Place spacer (5, Fig. 4-40) (where used) and main idler gear (3) in press and press main idler shaft (2) into spacer and gear.

NOTE: Shaft must be assembled into chamfered side of gear. Incorrect installation will result in gear and shaft failure.

Turn shaft over, place bearing (1) in press and press shaft (2) into bearing.

NOTE: Coat shaft with Molykote or equivalent lubricant prior to installation of gear and bearing.

NOTE: Prior to assembly heat bearing inner race to 250° F. in oil or an oven.

Install heated bearing inner race (4) with shoulder toward gear.

Install spacer (4, Fig. 4-38), transmission output high gear (3), spacer (2) and heated bearing inner race (1) with shoulder toward gear on gather shaft (5).

NOTE: Prior to assembly, heat bearing inner races to 250° F. in oil or an oven.

Install snap rings (4, 6, Fig. 4-38) on reverse idler shaft (5). Install reverse transfer driven gear (3), snap ring (2) and heated (smaller diameter) bearing inner race (1) with shoulder toward the gear.

Install reverse transfer drive gear (7), snap ring (8) and heated (larger diameter) bearing inner race (9) with shoulder toward the gear.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

NOTE: Prior to assembly, heat bearing inner races to 250° F. in oil or an oven.

NOTE: Be sure bearing inner races are properly seated.

Install spacers (4, Fig. 4-37) in their proper bearing bores in small cover (2). Install bearings (1) using a wooden block or mallet.

NOTE: Drive on bearing outer races only.

Be certain bearings are properly seated at bottom of bores. Coat the O. D. of a new input shaft seal with "Mar-Seal" or equivalent sealant. Press seal in cover bore with spring reinforced lip of seal facing bearing (3).

Install a new gasket (3, Fig. 4-36). Install cover (2) and secure with cap screws (1). Be sure cover is positioned on dowels (4).

Install filter assembly (2, Fig. 4-35) and a new gasket. Secure with cap screws (1) and washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Rotate transmission until output shaft bore is at bottom. Install oil baffle (1, Fig. 4-49).

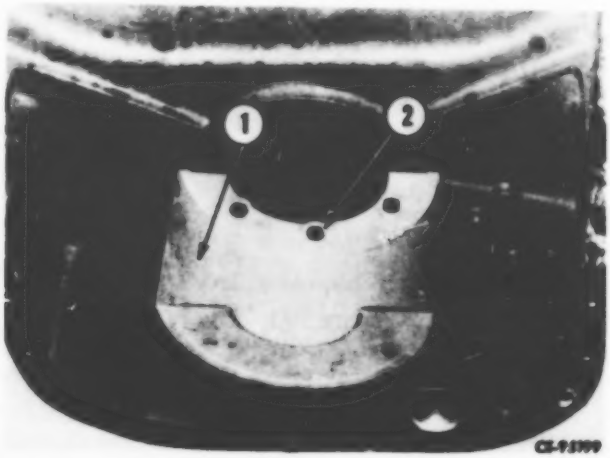


Figure 4-49

Tighten cap screws (2) to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install output shaft rear retainer (2, Fig. 4-50) and secure with a pair of cap screws, 180° apart. Snug up cap screws just enough to hold retainer in place.

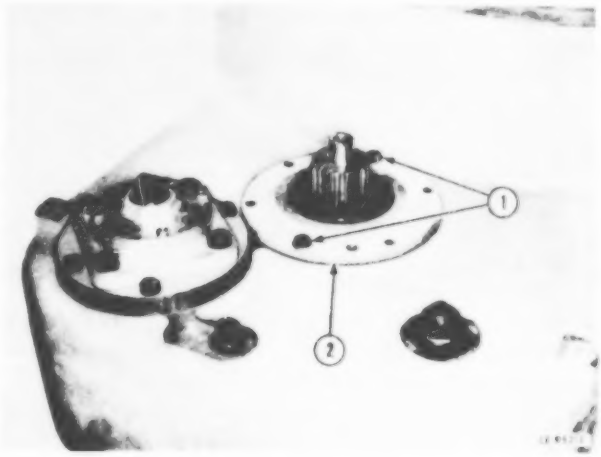


Figure 4-50

Install assembled output shaft (1, Fig. 4-51) in its bore in housing (2).

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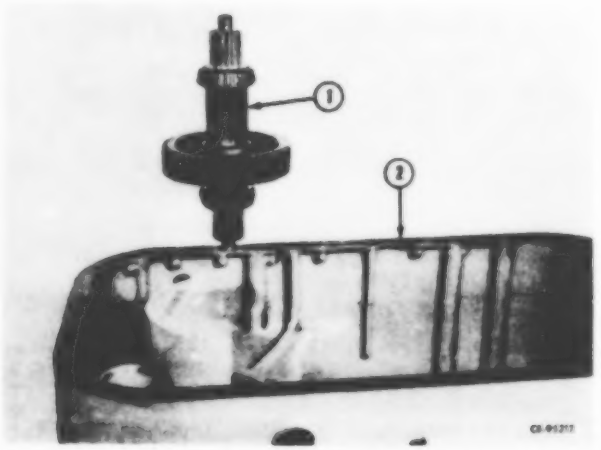


Figure 4-51

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY - Continued

Position transmission horizontally. Install main idler shaft and gear assembly (1, Fig. 4-31).

NOTE: Prior to installation in transmission, lubricate all shaft bearing surfaces and bearings with oil soluble grease.

Attach special lifting tool (2, Fig. 4-30) (refer to "SPECIAL TOOLS") in oil supply groove of 1st-3rd clutch pack (1) (pack with large input gear) and install assembly in transmission.

NOTE: Do not attempt to lift any of the clutch packs by the oil supply ports.

Attach special lifting tool to oil supply groove in 2nd-4th clutch pack (1, Fig. 4-52) and install assembly in transmission.

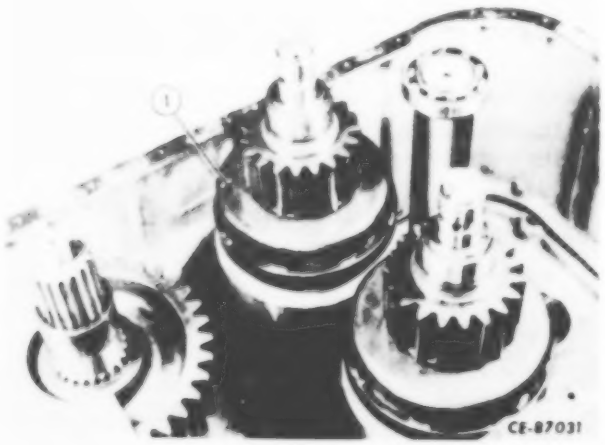


Figure 4-52

Grasp large (low speed) gear (1, Fig. 4-53) on gather shaft (2) and install assembly in transmission by slightly turning shaft to align gear teeth and cocking low speed gather gear (1) toward bottom of housing.

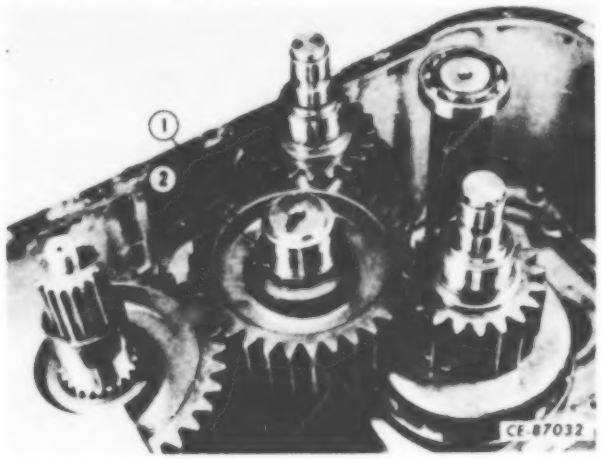


Figure 4-53

Attach lifting tool (1, Fig. 4-54) to directional clutch pack (3) and lower clutch pack into transmission. At the same time install reverse idler shaft assembly (2). The larger gear on the reverse idler shaft is in the up position.

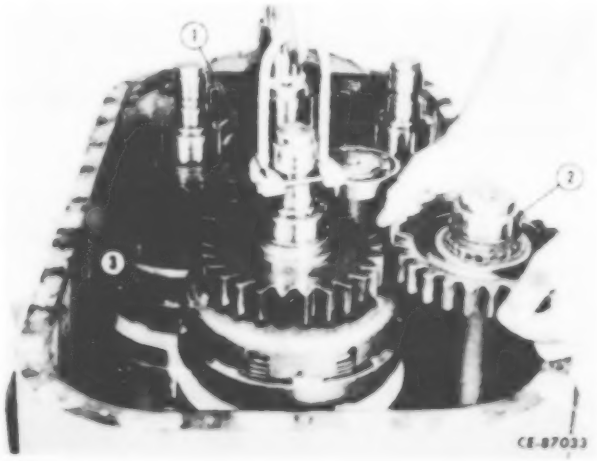


Figure 4-54

Install new "O" rings (1, Fig. 4-26) on oil transfer tubes (2). Coat "O" rings with grease and install transfer tubes in transmission. Be sure tubes are bottomed in their respective bores.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Before installing cover check the following:

1. Be sure directional oil supply seal rings have been properly installed and are coated with grease.

2. Be sure all gears are properly meshed.

3. Be sure all bearings are properly seated.

4. Transmission housing must be free of all foreign material, tools etc.

5. Be sure "O" rings on oil transfer tubes are well greased.

Place new gasket (1, Fig. 4-55) on transmission housing, retaining it with grease. Support cover on hoist as level as possible. Lower cover slowly, aligning both range clutch shafts and bearings with their respective bearing bores in cover. Align the two oil transfer tubes (3) using a pair of screw drivers. Lower cover and align on dowels (2). Gently tap cover down with a mallet. Do not force cover by pulling it down with cap screws. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

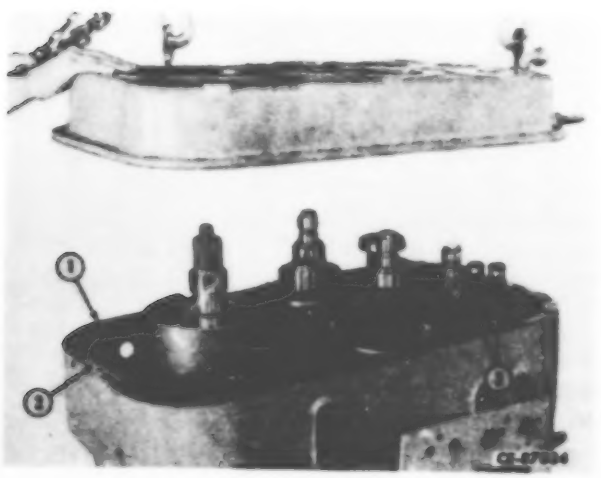


Figure 4-55

Align a new range selector valve gasket (4, Fig. 4-56) on valve mounting pad (1). Coat new seal ring (2) with grease and install on selector valve (3). Mount valve on transmission using cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

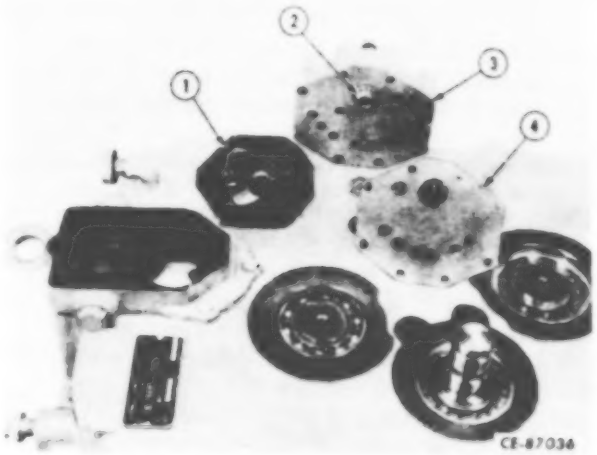


Figure 4-56

Install a new neutral knock down valve gasket (2, Fig. 4-57) on valve mounting pad. Be sure holes in gasket and transmission are correctly aligned.

NOTE: Be sure directional oil supply cover (3) is in correct alignment.

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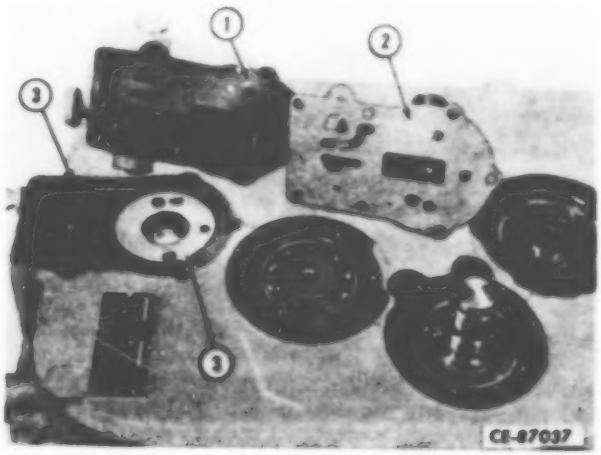


Figure 4-57

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY - Continued

Install valve body (1) with cap screws and lock washers.

NOTE: Do not tighten cap screws until directional selector valve has been installed.

Install new directional selector valve gasket (2, Fig. 4-22) on neutral knock down valve. Install directional selector valve (1) and secure with cap screws (3) and lock washers. Tighten all cap screws (knock down and selector valves) to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install new idler shaft gasket and gather shaft gasket (2, Fig. 4-21). Align holes and install idler shaft cover (1) and gather shaft cover (3). Retain covers with cap screws and lock washers. Tighten all cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install two new range clutch oil supply cover gaskets (1, Fig. 4-58). Align holes in gaskets and transmission. Be sure new "O" rings (3) are installed in both oil supply covers (2). Secure "O" rings in their bores with an application of grease. Install oil supply covers and secure with cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

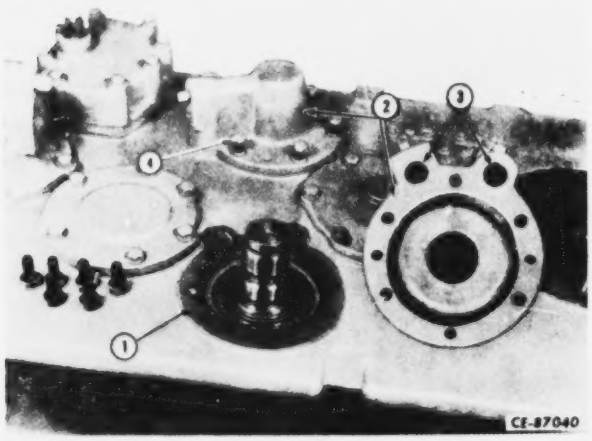


Figure 4-58

NOTE: Install oil supply covers carefully to avoid damage to seals.

Install output shaft front bearing retainer (1, Fig. 4-59) with new "O" ring on transmission. Secure with cap screws (2) and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

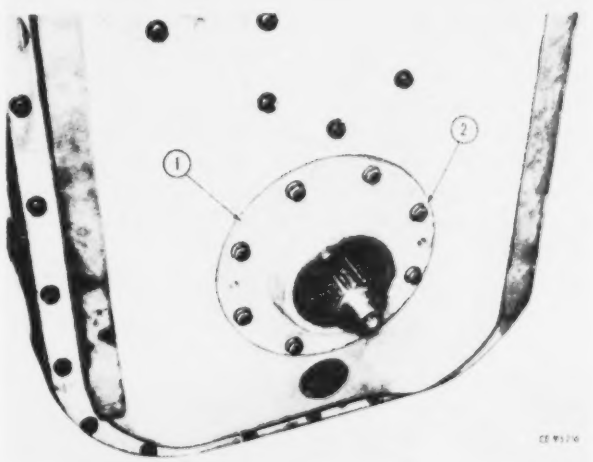


Figure 4-59

Secure transmission in a vertical position. Grasping the end of the output shaft where it protrudes from the loose retainer, "roll" the shaft into the opposite (tightened) bearing retainer. Exert a heavy pressure (thrust) in this direction. This "rolling in" procedure is designed to seat the bearing assembly squarely and firmly in its retainer.

Loosen the two cap screws installed previously in output shaft rear retainer. Torque cap screws (Fig. 4-60) to recommended preliminary torque (refer to "SPECIAL TORQUES").

Torque:_____



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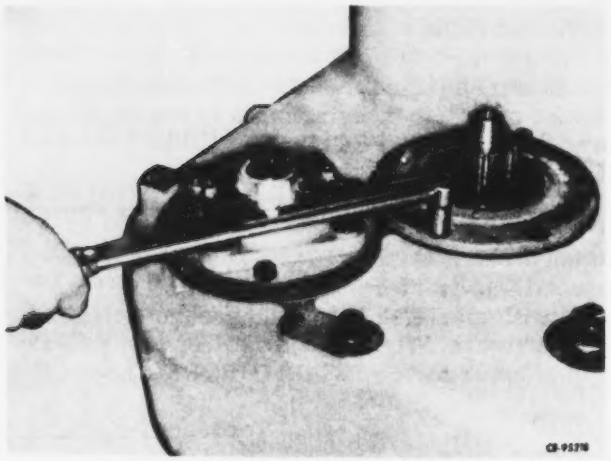

Figure 4-60

NOTE: Continue to "roll" output shaft while torquing cap screws.

Rotate the output shaft several times. Torque the two cap screws to the secondary torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Rotate the output shaft several times to seat the bearings. Use a feeler gauge to measure the gap between the housing and the end cap at each cap screw (Fig. 4-61). If the readings are not the same, total the two readings and divide by 2. To this reading add .025". Make up a shim pack equal to this thickness. Install the shim pack between the end cap and the housing. Install the end cap and secure with cap screws and lock washers. Tighten the cap screws to the final torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

Install a dial indicator on the transmission as shown (Fig. 4-62). Place a jack under the opposite end of the output shaft (do not contact the shaft). Using a pry bar to exert pressure on the end of the shaft, note the reading on the dial indicator. This distance should be within that recommended (refer to "TOLERANCES" under "SERVICE INFORMATION").

Output shaft end play: _____

If reading is not within recommended limitations, the shim pack should be corrected.

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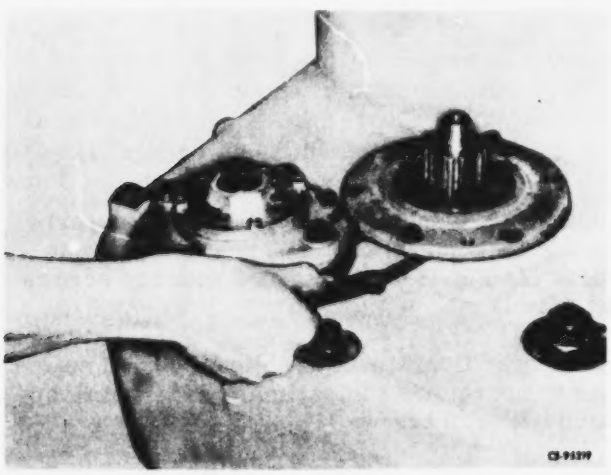

Figure 4-61

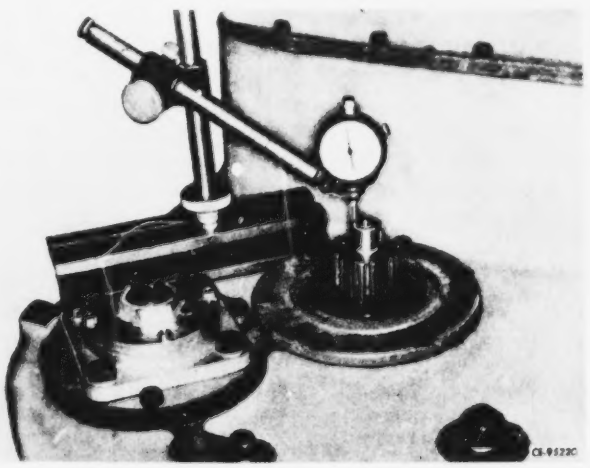

Figure 4-62

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY - Continued

Install rear output yoke (5, Fig. 4-63), gasket (2) and washer (3). Secure with new nut (4). Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

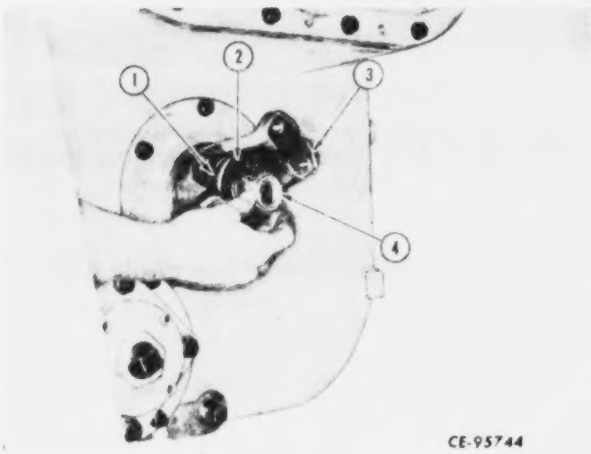


Figure 4-63

Install front output yoke (4, Fig. 4-18), gasket (3) and washer (2). Secure with nut (1). Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Place transmission upright. Lubricate input yoke sealing surface (4, Fig. 4-17) and lips of seal with grease. Align splines of shaft and yoke and install yoke on input shaft. Install retaining washer (3) and new locking plate (2) and secure with cap screws (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES"). Lock cap screws by bending up tabs on locking plate.

Torque:_____

Align holes and install new main regulator valve gasket (2, Fig. 4-16) and main regulator valve (1). Secure with cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

### INSTALLATION

Install transmission mounts on transmission. Tighten mount-to-housing bolts to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Attach a chain hoist to lifting eyes, lift transmission into tractor aligning mounts (1, Fig. 4-15) with mounting holes and secure to frame with hardware. Tighten bolts to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Secure brackets (2, Fig. 4-14) to top of transmission with hardware. Install demand valve and secure with hardware.

Connect transmission-to-torque converter drive shaft (1, Fig. 4-13). Refer to Section V, "DRIVE SHAFTS" for correct drive shaft mounting torques.

Connect all hoses to transmission. Connect reservoir-to-loader control valve hoses (1, 3, Fig. 4-12) to bracket (2). Connect pump-to-valve hose (4), valve-to-loader valve hose (7) and valve-to-steering valve hose (5) to demand valve (6).

Connect transmission-to-rear axle drive shaft (1, Fig. 4-11) to transmission (4). Connect sump hose (2) and strainer hose (3).

Connect transmission-to-parking brake drive shaft (3, Fig. 4-10) to transmission (4). Connect magnetic sensor (5) (where used) to transmission. Connect transmission linkage (1) to bellcrank (2).

Attach a sling and hoist to operator's compartment. Lift compartment into position on front frame (2, Fig. 4-9) and secure with cap screws and nuts (3).

Install rear floorboards (2, Fig. 4-8) and secure to operator's compartment and front floorboard with cap screws (1).

Connect control rods (2, Fig. 4-7) to hydraulic control valve levers (1) with cotter pins and pins (3). Mount bracket (4) to rear floorboard (5).



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Position ladder on tractor. Secure ladder and hand rail to front frame and operator's compartment with cap screws (1, 2, Fig. 4-6).

## CLUTCH PACKS

With the exception of the removal of the drive gears on the range clutch assemblies, both range and directional clutch packs are serviced in the same manner. Where specific differences between the two assemblies arise these will be noted in the text.

### DISASSEMBLY

DIRECTIONAL CLUTCHES - Remove snap ring (1, Fig. 4-64) from end of clutch shaft with oil supply ports. Using a hydraulic puller, remove bearing inner race (2).

NOTE: Place a steel plate approximately 3" x 3" x 3/4" between puller and oil supply plug on end of shaft. Do not push directly on plug.

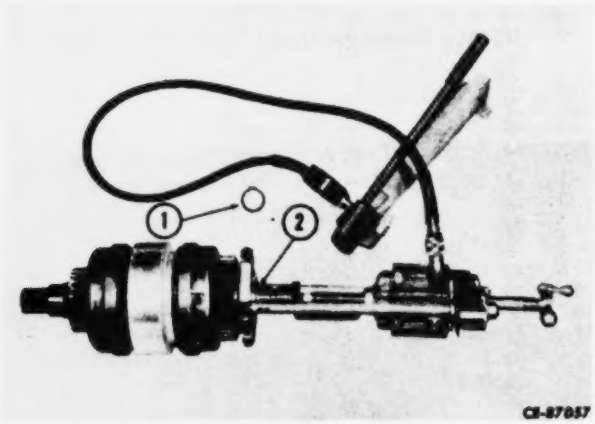


Figure 4-64

Remove bearing race from opposite end of clutch shaft.

RANGE CLUTCHES - Remove snap ring from end of shaft. Using a hydraulic puller as shown remove the input gear (1, Fig. 4-65) and bearing inner race (2) together.

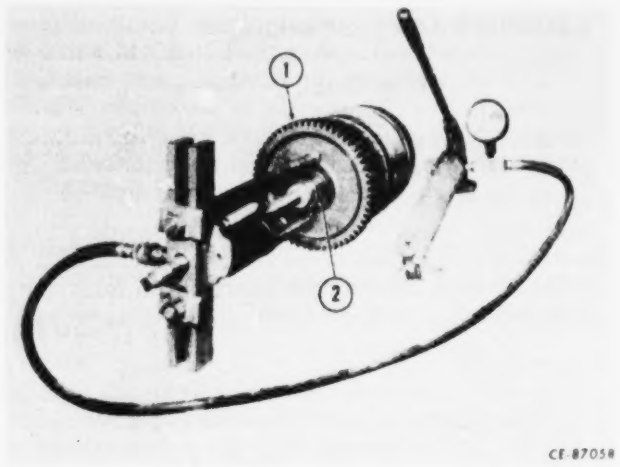


Figure 4-65

Remove snap ring from opposite end of shaft. Using a hydraulic puller as shown in Fig. 4-64, remove the bearing inner race.

ALL UNITS - Remove spacer (3, Fig. 4-66), spacer (4), thrust washer (5) and spacer (6).

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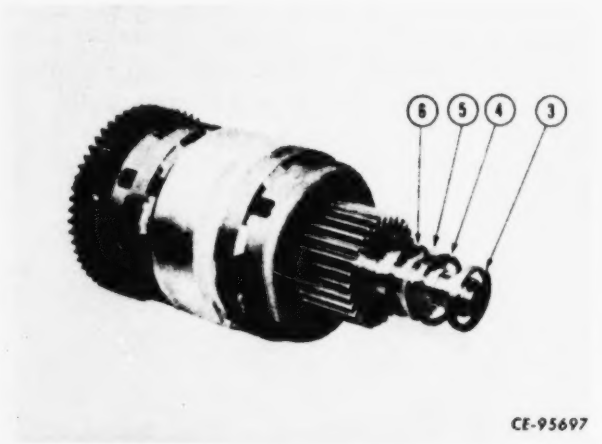


Figure 4-66

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### CLUTCH PACKS - Continued

DISASSEMBLY - Continued

Remove gears (4, Fig. 4-67) from the clutch shaft. Remove bearings (1 and 2) and spacers (3) from clutch shaft.

NOTE: Do not allow the bearings to fall on the bench.

NOTE: Do not attempt to separate drive gear and cup. They are serviced as an assembly only.

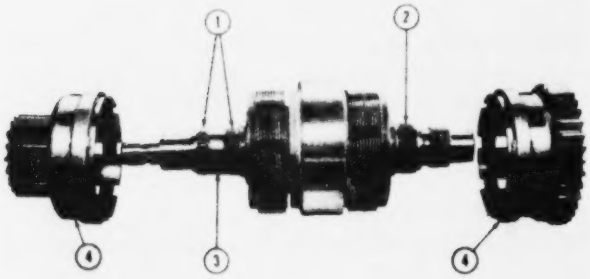


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Figure 4-67

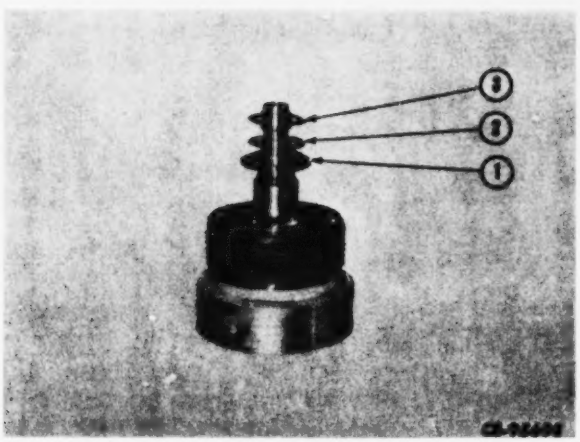


Figure 4-68

Remove spacer (3, Fig. 4-68), thrust washer (2) and spacer (1).

Remove cap screws (2, Fig. 4-69) that secure the clutch hub retainers (3). Remove retainers. Lift the hub and plate assembly (4) from the shaft (1).

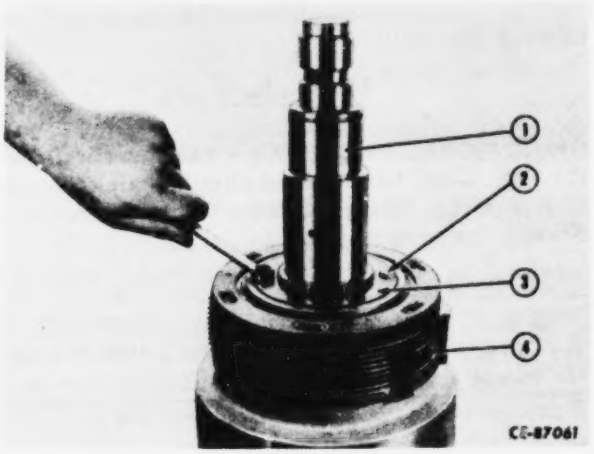


Figure 4-69

Remove Spir-O-Lox retaining ring (1, Fig. 4-70) from the hub and plate assembly (2).

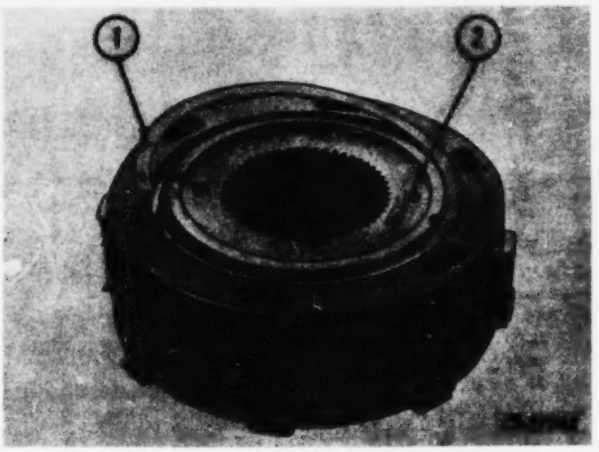


Figure 4-70



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove snap ring (1, Fig. 4-71) from the hub and plate assembly.

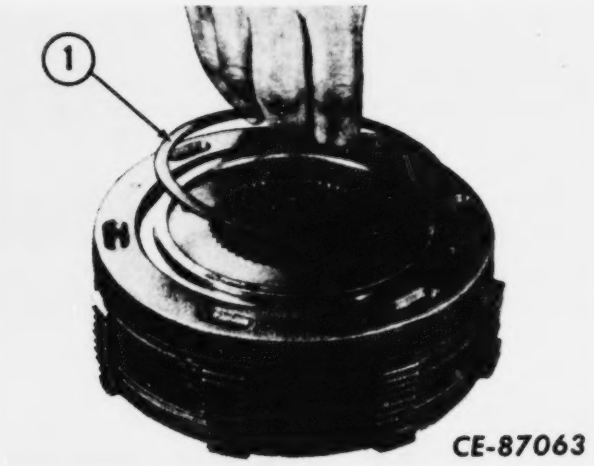


Figure 4-71

Remove backing plate (2, Fig. 4-72) from hub and plate assembly. Remove dowel pin (3).

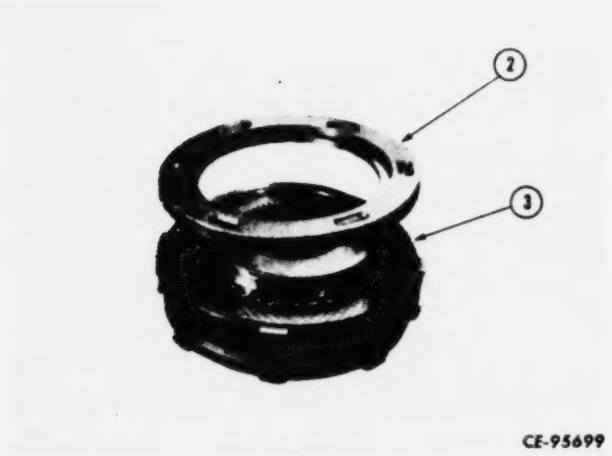


Figure 4-72

Clutch plates, bronze (1, Fig. 4-73) and steel (3), may be lifted from the clutch hub assembly (2).

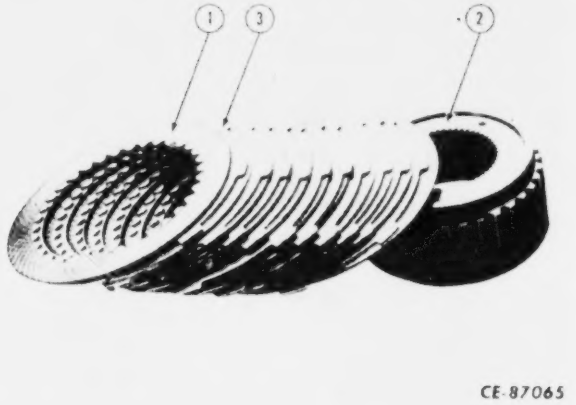


Figure 4-73

Using a plastic mallet, tap clutch piston (1, Fig. 4-74) down making snap ring (2) accessible. Remove snap ring.

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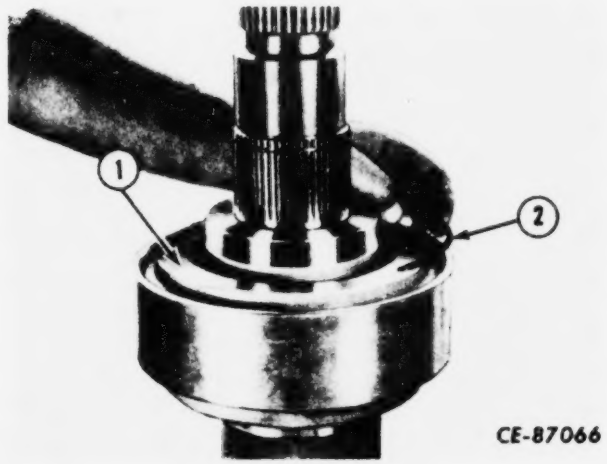


Figure 4-74

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### CLUTCH PACKS - Continued

DISASSEMBLY - Continued

Install special snap ring groove filler (2, Fig. 4-75) (refer to "SPECIAL TOOLS") with bevel edge down in piston housing (1) snap ring groove.

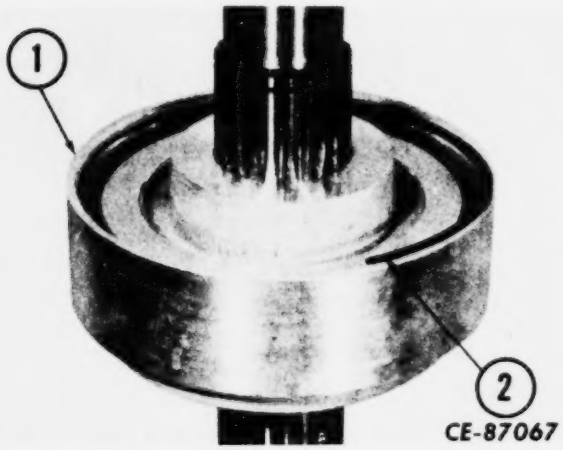


Figure 4-75

Using a plastic mallet, tap around outer edge of piston housing (1, Fig. 4-76).

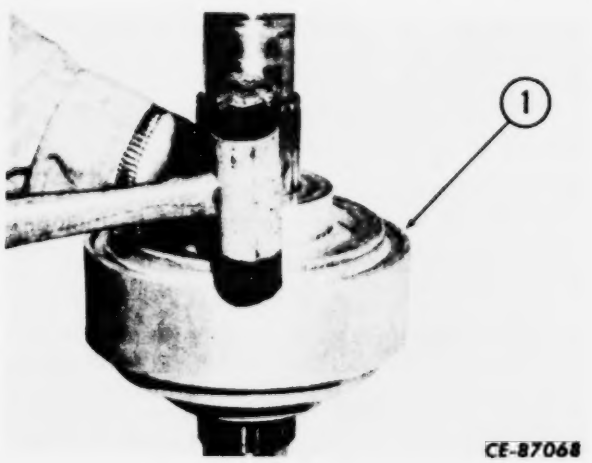


Figure 4-76

NOTE: Do not allow piston housing to fall on bench.

Remove clutch piston (1, Fig. 4-77) and rectangular seal ring (2). Remove special tool.

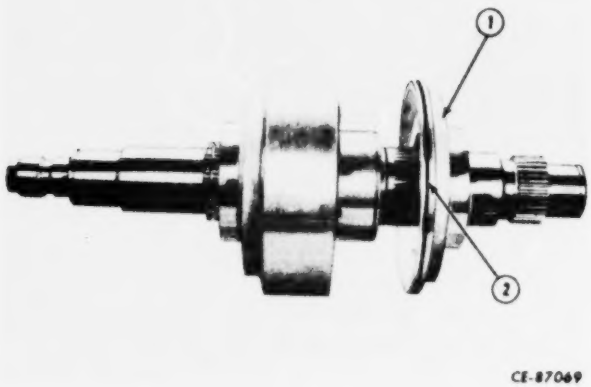


Figure 4-77

Remove piston housing (1, Fig. 4-78) and "O" ring (2) from shaft.

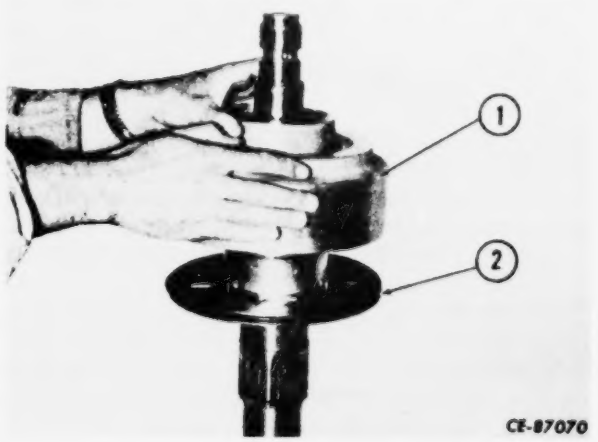


Figure 4-78

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove the hook-type seal rings (1, Fig. 4-79) from the clutch shaft assembly.

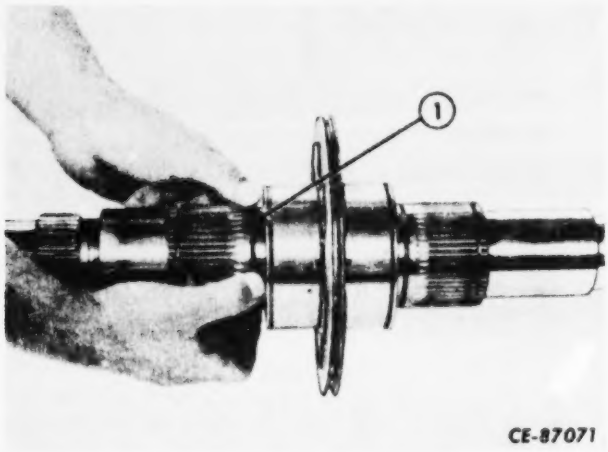


Figure 4-79

Remove the accelerating pistons retaining snap rings (3, Fig. 4-80). Remove the accelerating pistons (1). Remove hook-type seal rings (2) from pistons.

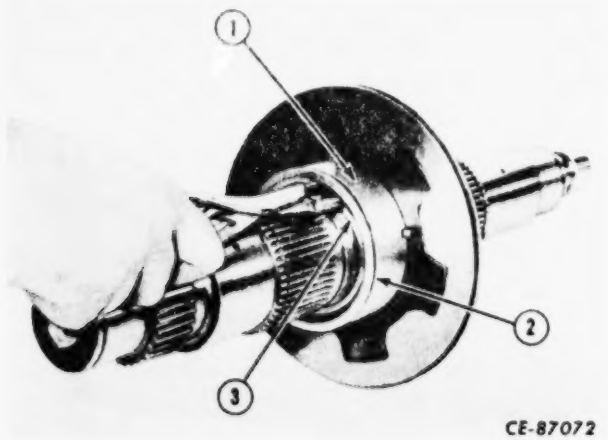


Figure 4-80

Remove disc valve (1, Fig. 4-81), reinforcing disc (2), hook-type seal ring (3) and dowel pins (4).

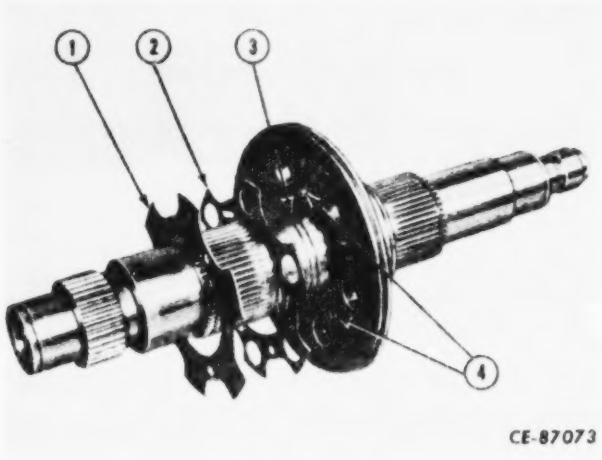


Figure 4-81

The following items are called-out for identification (Fig. 4-82):

1. Reverse oil supply plug.
2. Reverse oil supply port.
3. Forward oil supply port.
4. Lube oil holes.
5. Separator plate.
6. Separator plate locating snap ring.
7. Oil transfer holes.

NOTE: Shaft is serviced as an assembly only. If locating snap rings, shaft or separator plate are damaged, entire assembly must be replaced.

(Continued on next page)

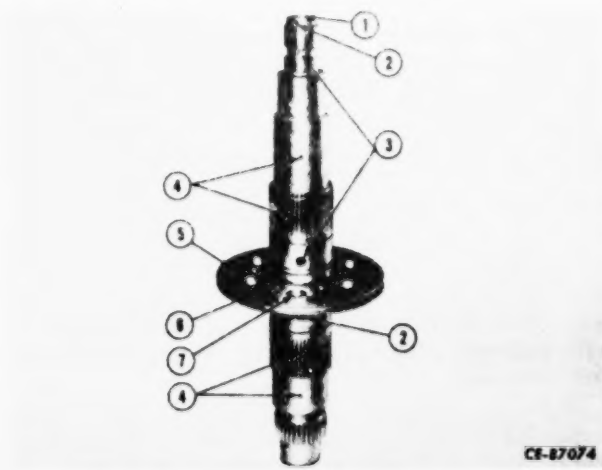


Figure 4-82

## CLUTCH PACKS - Continued

### CLEANING AND INSPECTION

Cleaning and inspection of the clutch assembly in preparation for assembly should include the following:

Clean all parts thoroughly in solvent. Use compressed air to dry parts. Carefully inspect all parts for excessive wear, cracks and/or breakage. All bores must be perfectly clean.

Inspect splines on all shafts and drive gears for excessive wear.

Inspect all sealing surfaces for wear and/or grooving.

Inspect bearing inner races and bushings for pits and spalled areas. Replace bearings and bushings that are pitted or spalled.

Inspect sintered bronze and steel discs for wear, signs of burning and/or warping. Replace discs if any of these conditions exists.

Replace all seals, hook-type seal rings, "O" rings and snap rings.

Use a heavy non-fibrous grease with a low melting point during assembly.

NOTE: Drive gear and drive cup assembly bushing wear limits together with thrust washer wear limits are located in "TOLERANCES."

NOTE: Special torque recommendations are listed under "SERVICE INFORMATION." This simplifies revision, when necessary. To eliminate constant referral, blank spaces are provided at points where special torques are required. These may be filled in by the manual holder, in pencil, and revised when necessary.

### ASSEMBLY

Place shaft horizontally on bench. Install new hook-type seal rings (2, 3, Fig. 4-83) on inner shaft grooves.

NOTE: Use caution when installing hook-type seal rings to avoid breaking rings.

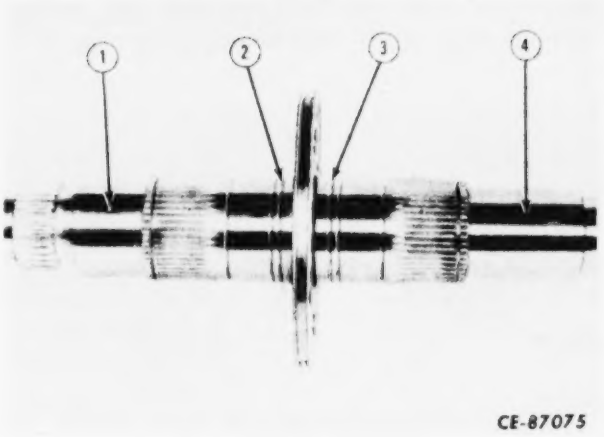


Figure 4-83

DIRECTIONAL CLUTCH - Be sure roll pins (1, 4, Fig. 4-83) are in place and bores are clean.

ALL UNITS - Install dowel pins (4, Fig. 4-81) in separator plate. Install a reinforcing disc (2) on each side of the separator plate.

Install a disc valve (1) on each side of the separator plate. Align reinforcing discs and disc valves on dowel pins.

Install a hook-type seal ring (1, Fig. 4-84) on each accelerating piston.

Install pistons on shaft.

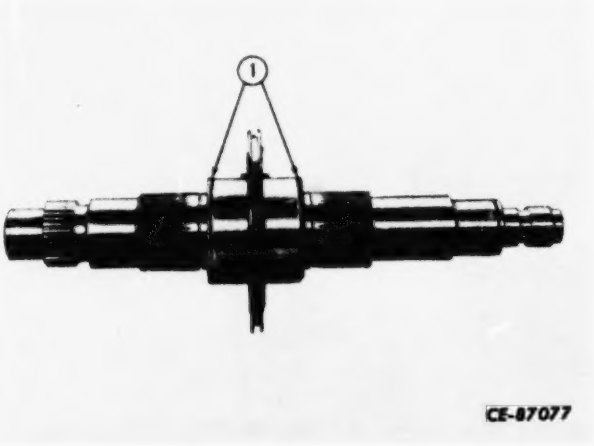


Figure 4-84

## DISASSEMBLY, INSPECTION AND ASSEMBLY

NOTE: Use caution when installing pistons to prevent breaking hook-type seal rings on shaft. Lubricate seal rings and inner bore of accelerating pistons liberally with clean transmission fluid or grease before assembling.

Install the snap rings (3, Fig. 4-80) that retain the accelerating pistons (1).

Place shaft in vertical position with reverse oil supply plug down. Install new hook-type seal ring (1, Fig. 4-85) in groove on shaft.

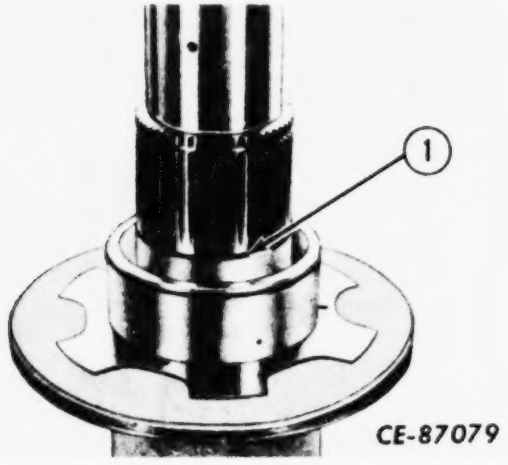


Figure 4-85

Install new rectangular seal ring (1, Fig. 4-86) on clutch piston outer diameter. Coat seal ring on shaft and accelerating piston and inner bore of clutch piston with grease or clean transmission fluid. Install clutch piston (2) on shaft assembly being careful not to damage hook-type seal rings.

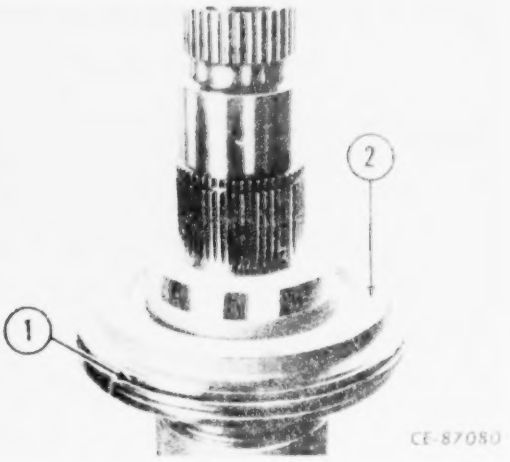


Figure 4-86

Invert shaft. Install new hook-type seal ring (2, Fig. 4-87) in groove on shaft. Install new "O" ring (1) on outer diameter of separator plate. Coat both seals with heavy grease. Coat rectangular seal (3) on clutch piston with grease.

(Continued on next page)

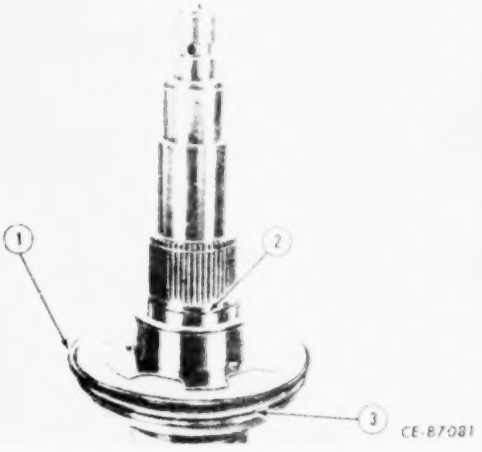


Figure 4-87

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### CLUTCH PACKS - Continued

ASSEMBLY - Continued

Install special snap ring groove filler, (refer to "SPECIAL TOOLS") bevel edge up in groove of piston housing. Lubricate groove area and mouth of piston housing with heavy grease.

Install piston housing (1, Fig. 4-88) on shaft assembly.

NOTE: The "O" ring (3) is larger in diameter than the separator plate. This design allows the inside diameter of the piston housing (1) to compress the seal ring to the proper fit.

Carefully "feed in" the "O" ring seal (3) while applying pressure to the piston housing (1). Push piston housing over "O" ring seal and clutch piston (2).

NOTE: Care must be taken during assembly to prevent cutting or otherwise damaging seal rings.

Invert the shaft assembly. Depress the clutch piston (1, Fig. 4-74) into the piston housing. Remove the special snap ring groove filler. Install the snap ring (2).

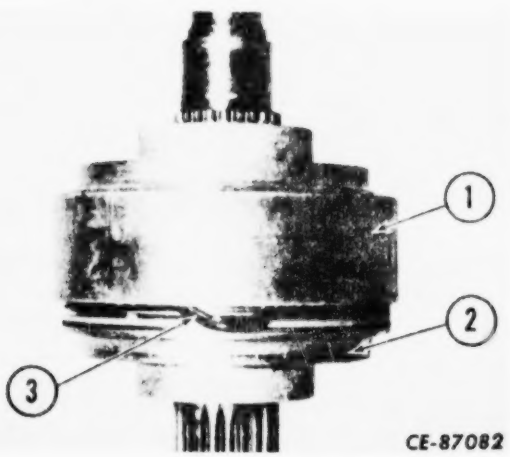


Figure 4-88

Apply air pressure to oil port holes to check operation of clutches. The clutch piston/piston housing assembly should move freely (Fig. 4-89).

NOTE: DO NOT exceed 100 psi air pressure.

NOTE: The next five steps apply to both sides of clutch pack.

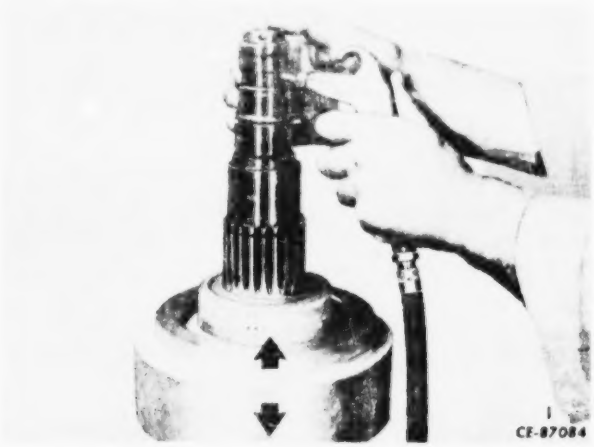


Figure 4-89

Install hub assembly (2, Fig. 4-90) and hub retainers (1). Tighten the retaining cap screws (3) to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

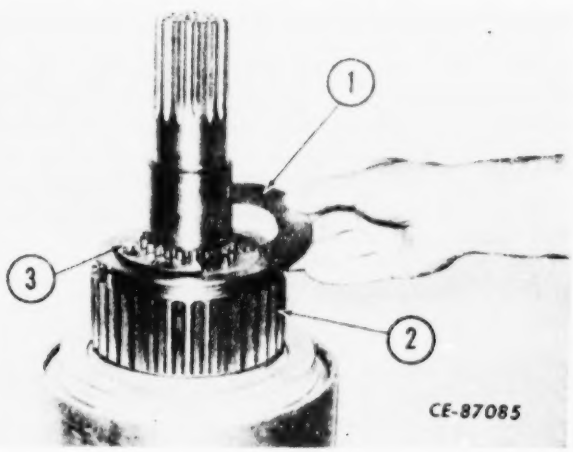


Figure 4-90

Install spacer (3, Fig. 4-91) and locking retainer bolts (4). Coat lightly with heavy grease and install bronze thrust washer (2) and thin spacer washer (1).

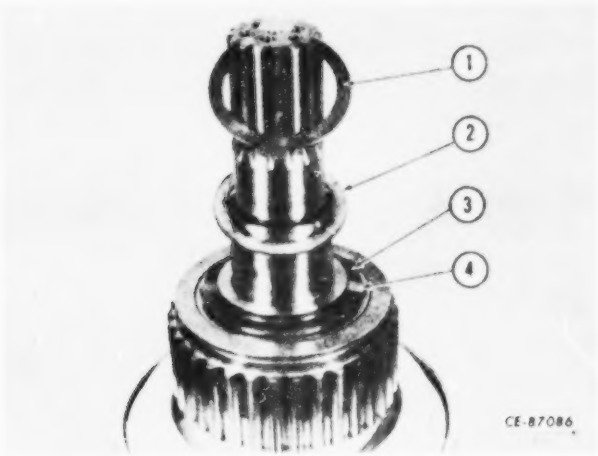


Figure 4-91

Install the correct number of steel and bronze plates (3, Fig. 4-92) alternately starting with a bronze plate. Refer to "SERVICE INFORMATION" for correct amount of plates.

With all plates (3, Fig. 4-92) installed, position the backing plate and install dowel pin (1).

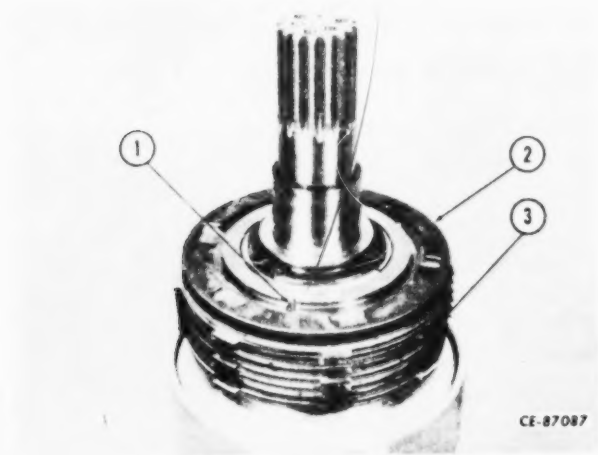


Figure 4-92

Install external snap ring (2, Fig. 4-93) in hub recess (1).

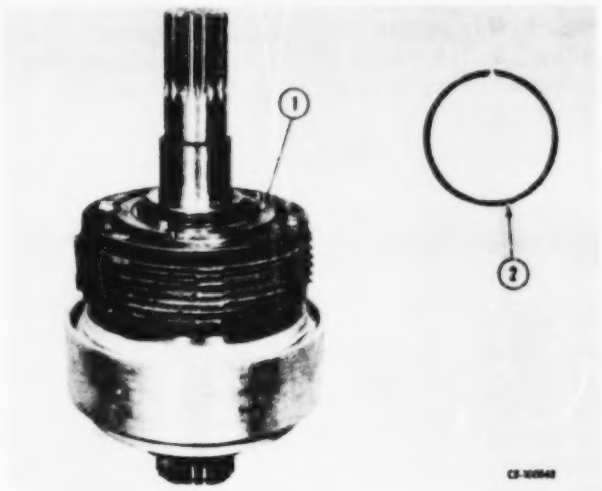


Figure 4-93

Install Spir-O-Lox retaining ring (1, Fig. 4-94) in backing plate (3). This locks in the external snap ring (2).

(Continued on next page)

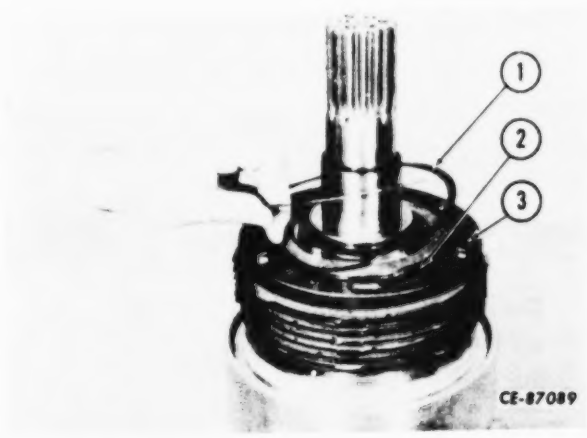


Figure 4-94

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### CLUTCH PACKS - Continued

ASSEMBLY - Continued

DIRECTIONAL CLUTCH - Install spacer (3, Fig. 4-95), roller bearing (2) and spacer (1) on splined end of clutch shaft. Cover rollers with a coat of heavy grease.

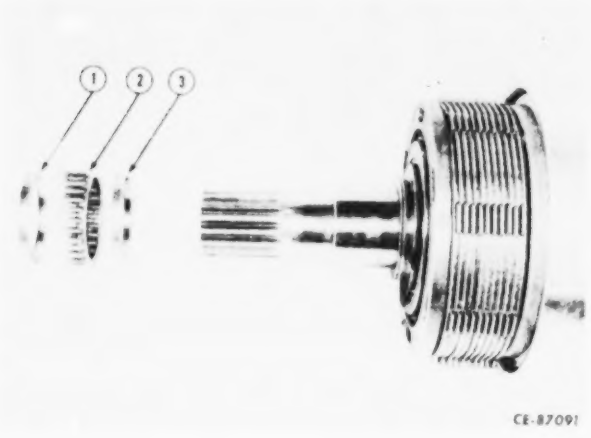


Figure 4-95

Install drive gear and cup assembly (4, Fig. 4-96) (small diameter, wide gear). Install spacer washer (3), bronze thrust washer (2) and spacer washer (1). Install wide spacer (6) with large diameter shoulder toward spacer washer (1). Install heated bearing inner race (5).

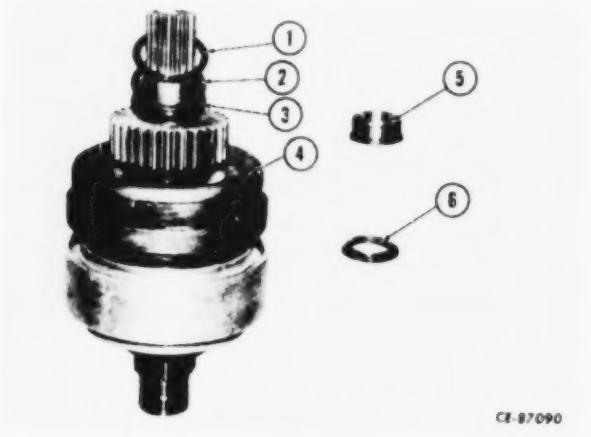


Figure 4-96

NOTE: Bearing inner race must be heated to 250° F. in oil or an oven prior to installation.

Install roller bearing (2, Fig. 4-97) and spacer (1) on oil supply port end of shaft. Cover rollers with a coat of heavy grease.

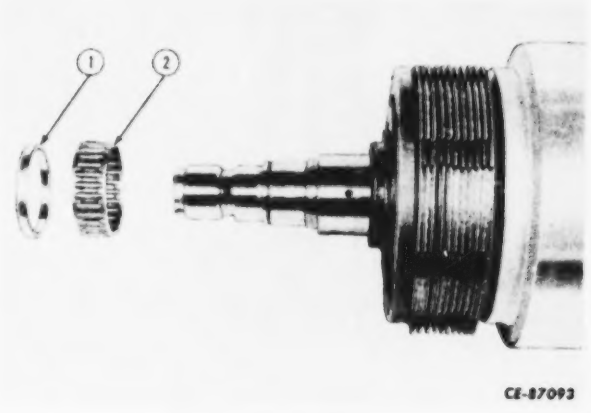


Figure 4-97

Install drive gear and cup assembly (7, Fig. 4-98) (large diameter, narrow gear). Install spacer washer (6), bronze thrust washer (5) and spacer washer (4). Install spacer (3) with large diameter shoulder toward spacer washer (4). Install heated bearing inner race (2).

NOTE: Heat bearing inner race to 250° F. in oil or an oven.

Install retaining snap ring (1).

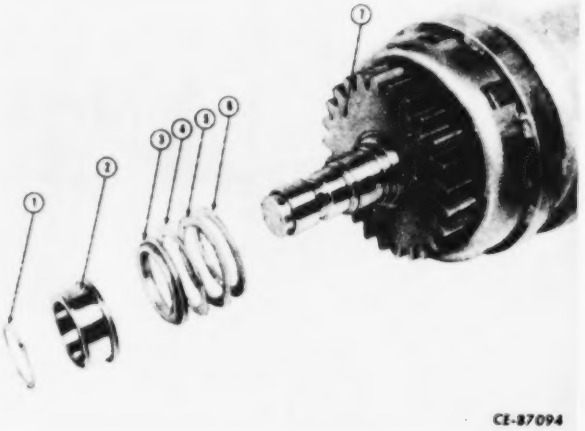


Figure 4-98



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

RANGE CLUTCH - Install roller bearing (3, Fig. 4-99), spacer (2) and roller bearing (1) on oil supply port end of clutch shaft. Cover rollers with a coat of heavy grease.

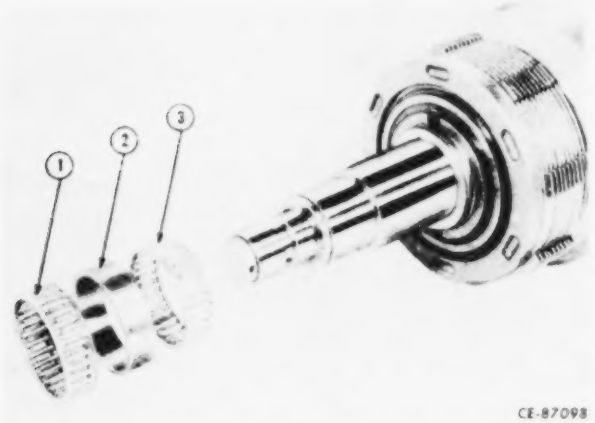


Figure 4-99

Install drive gear and cup assembly (7, Fig. 4-100) (small diameter, wide gear). Install spacer washer (6), bronze thrust washer (5) and spacer washer (4). Install spacer (3) with large diameter shoulder toward spacer washer (4). Install heated bearing inner race (2).

NOTE: Heat bearing inner race to 250° F. in oil or an oven.

Install snap ring (1) in groove.

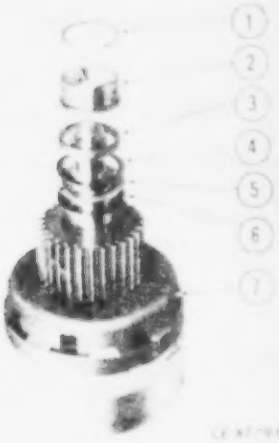


Figure 4-100

Install roller bearing (1, Fig. 4-101) on splined end of clutch shaft. Cover rollers with a coat of heavy grease.

(Continued on next page)

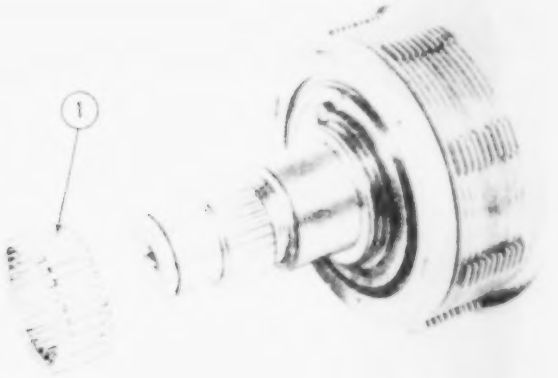


Figure 4-101

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### CLUTCH PACKS - Continued

ASSEMBLY - Continued

Install drive gear and cup assembly (4, Fig. 4-102) (large diameter, narrow gear). Install spacer washer (3), bronze thrust washer (2) and spacer washer (1).

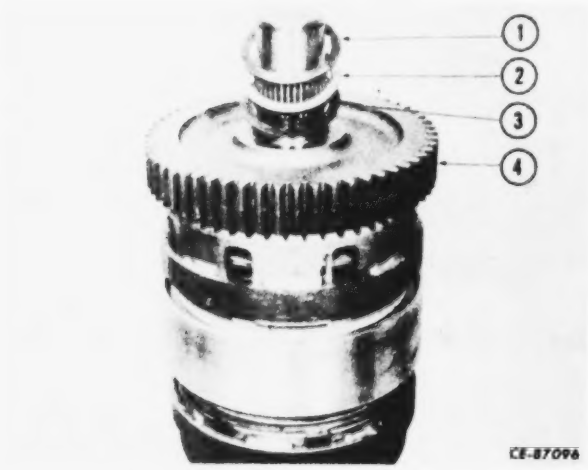


Figure 4-102

Install input gear (4, Fig. 4-103), long boss (3) out. Install heated bearing inner race (2).

NOTE: Heat bearing inner race to 250° F. in oil or an oven.

Install snap ring (1).

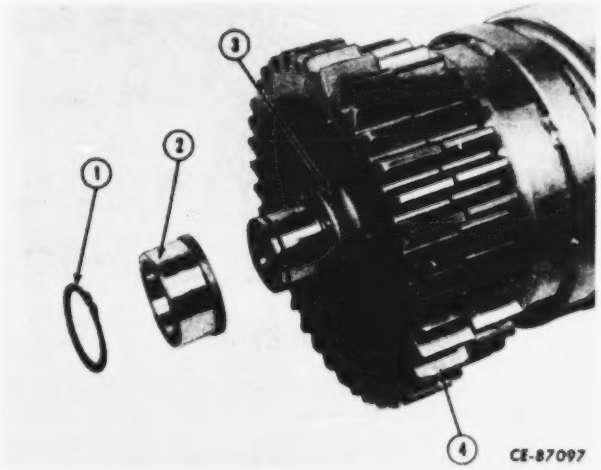


Figure 4-103



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DIRECTIONAL VALVE

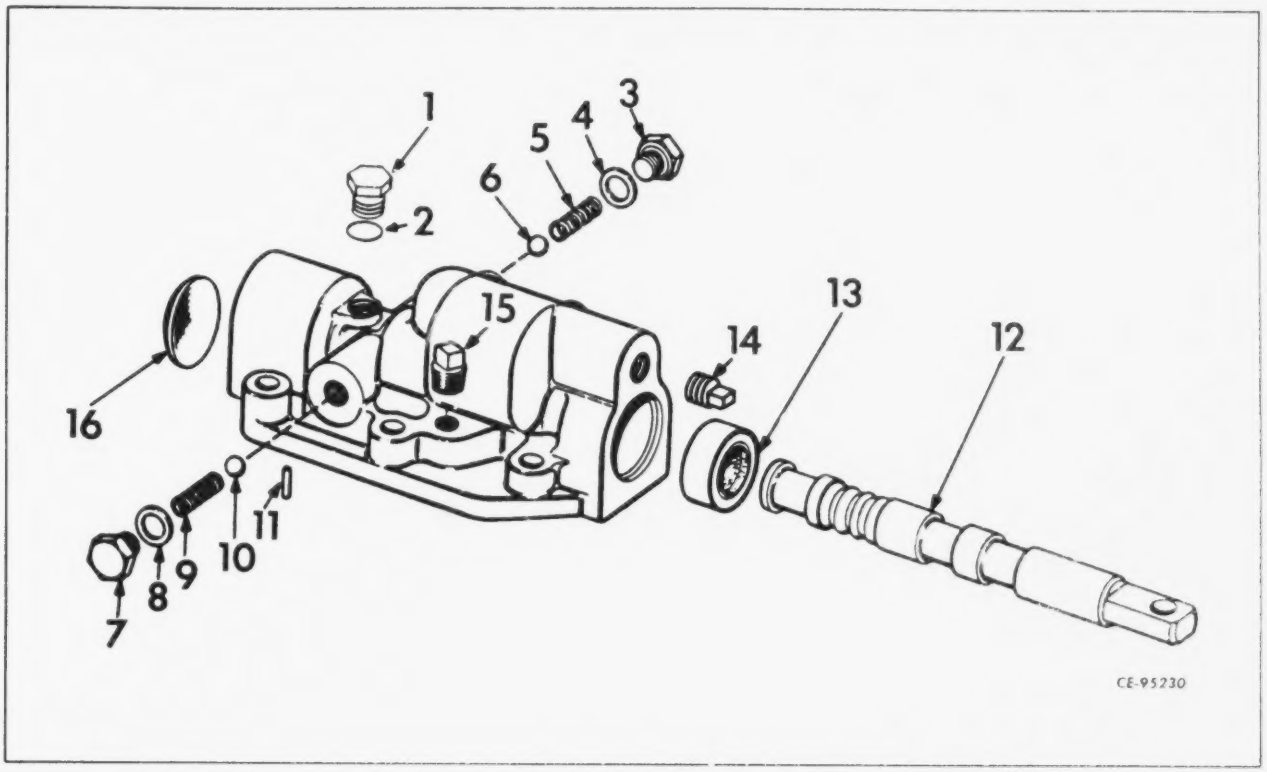


Figure 4-104
Directional Valve.

1. Plug.
2. "O" ring.
3. Plug.
4. Gasket.
5. Spring.
6. Ball.
7. Plug.
8. Gasket.
9. Spring.
10. Ball.
11. Pin.
12. Valve spool.
13. Seal.

Disassemble in numerical order.

Remove item 16 only if damaged or leaking.

Clean and inspect parts.

Replace parts: 2, 4, 8, 13.

Assemble in reverse order.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### RANGE VALVE

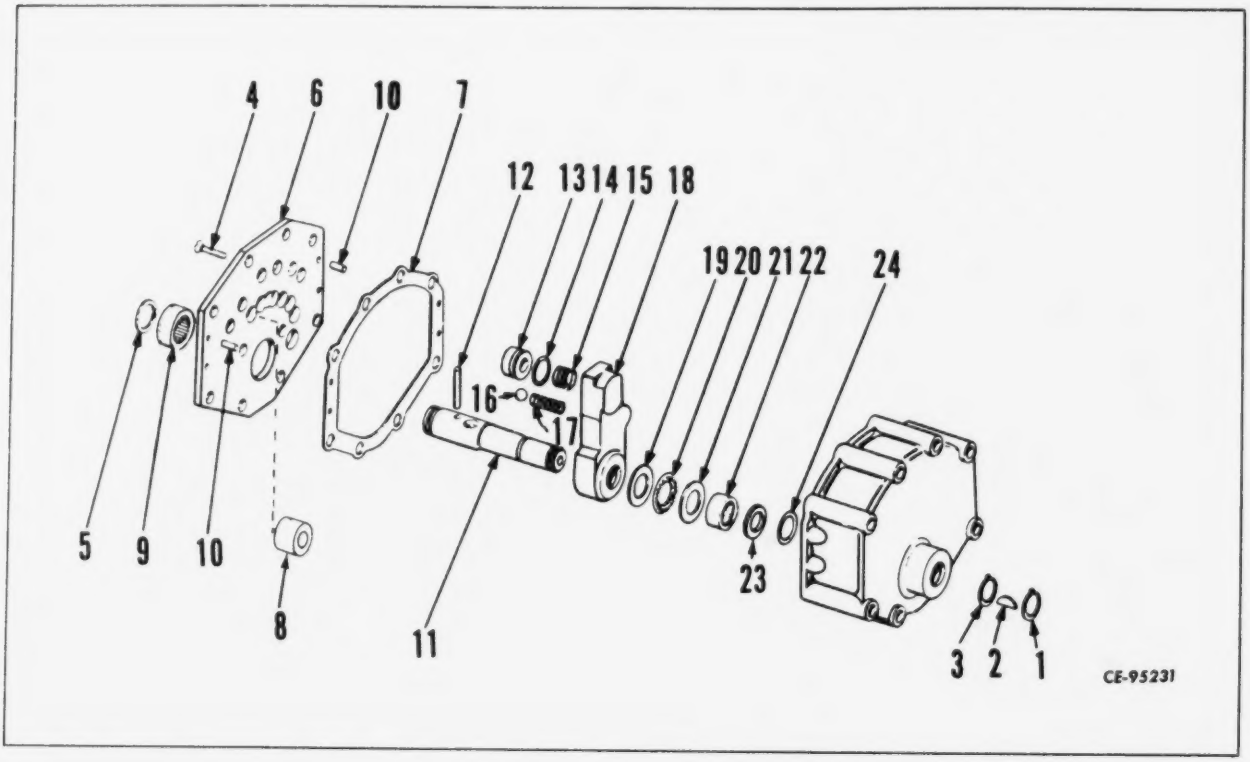


Figure 4-105
Range Valve.

1. Snap ring.
2. Key.
3. Snap ring.
4. Screw.
5. Seal ring.
6. Plate.
7. Gasket.
8. Spacer.
9. Needle bearing.
10. Pin.
11. Shaft.
12. Pin.
13. Oil inlet valve.
14. Seal.
15. Spring.
16. Ball.
17. Spring.
18. Valve.
19. Thrust washer.
20. Thrust bearing.
21. Thrust washer.
22. Needle bearing.
23. Washer.
24. Seal.

Disassemble in numerical order.

Clean and inspect parts.

Replace parts: 5, 7, 14, 24.

Assemble in reverse order.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### NEUTRAL KNOCKDOWN VALVE

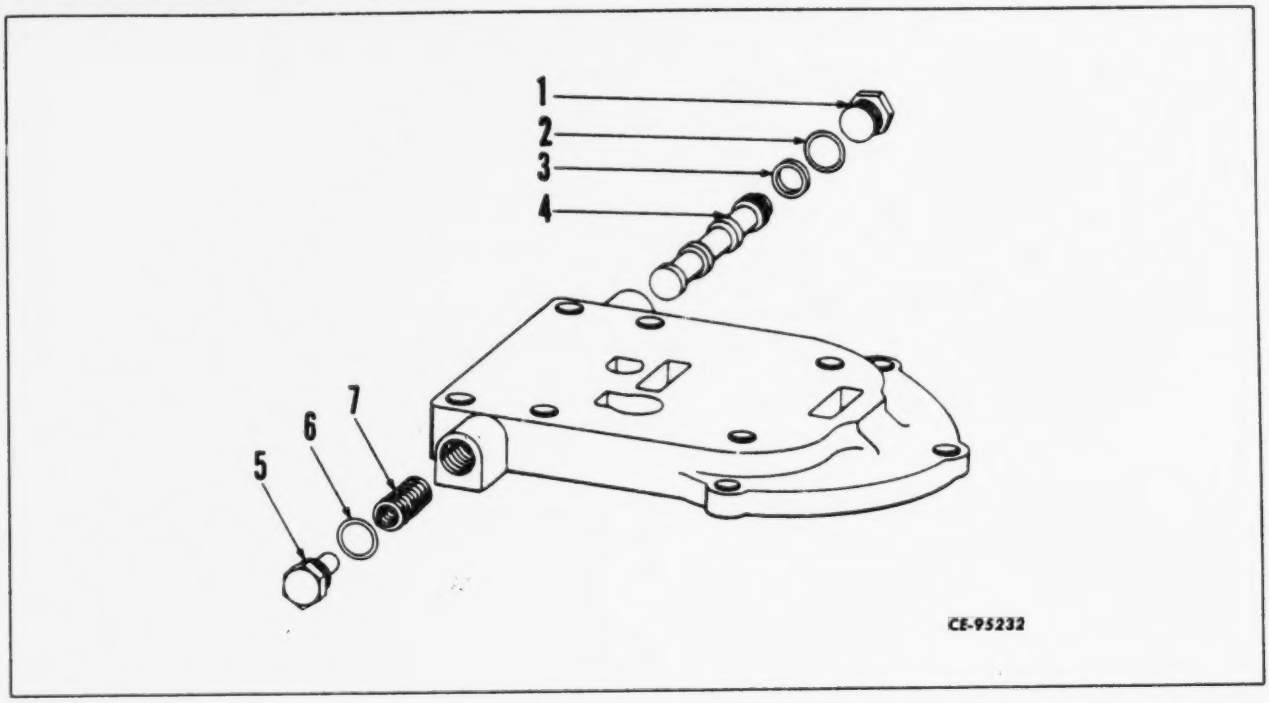


Figure 4-106
Neutral Knockdown Valve.

1. Plug.
2. Gasket.
3. Seal ring.
4. Valve spool.
5. Plug assembly.
6. Gasket.
7. Spring.

Disassemble in numerical order.

Clean and inspect parts.

Renew parts: 2, 3, 6.

Assemble in reverse order.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### MAIN REGULATOR VALVE

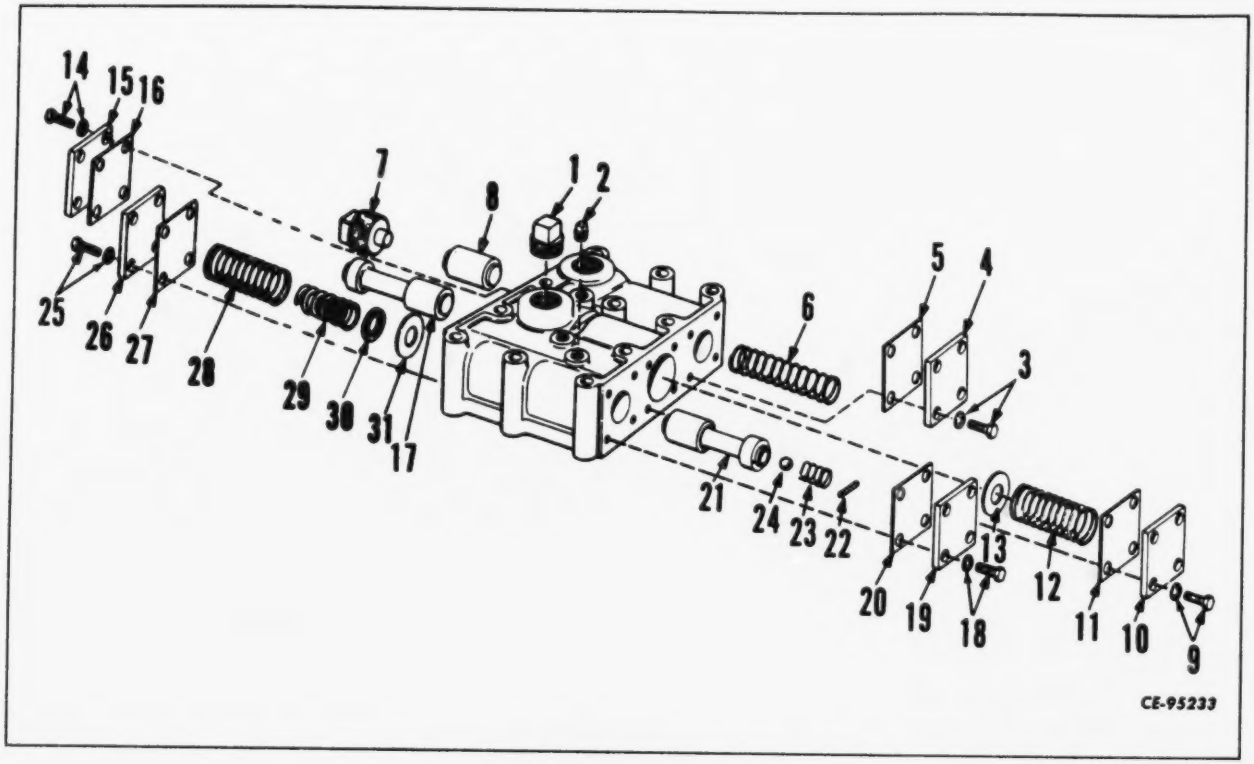


Figure 4-107
Main Regulator Valve.

1. Plug.
2. Plug.
3. Screw and washer.
4. Cover.
5. Gasket.
6. Spring.
7. Plug.
8. Lube valve.
9. Screw and washer.
10. Cover.
11. Gasket.
12. Spring.
13. Washer.
14. Screw and washer.
15. Cover.
16. Gasket.
17. Valve spool.
18. Screw and washer.
19. Cover.
20. Gasket.
21. Valve spool.
22. Pin.
23. Spring.
24. Ball.
25. Screw and washer.
26. Cover.
27. Gasket.
28. Spring.
29. Spring.
30. Washer.
31. Washer.

Disassemble in numerical order.

Clean and inspect parts.

Renew parts: 5, 11, 16, 20, 27.

Assemble in reverse order.

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## TROUBLE SHOOTING

Diagnostic Checks to be Made When Trouble Occurs:

(1) Transmission sump oil level.
(2) Cleanliness of oil and oil filter.
(3) Air flow through oil cooler.
(4) Condition of all oil lines and fittings.
(5) Condition of all wiring and connections.
(6) Engine-converter stall speed.
(7) Proper linkage positioning of all valves and levers.
(8) Converter and transmission oil pressures.
(9) All drive lines and mounting brackets for tightness.

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| High engine speed at converter stall. | 1. Low transmission sump oil level. | |
| | 2. Low converter "IN" pressure at stall. | 2. (a) Check external lines for leaks.<br>(b) See low converter "IN" pressure. |
| | 3. Slipping direction or range clutch. | 3. (a) Cross check direction and range clutches by applying other clutches to varify slipping.<br>(b) Observe movement in drive line between converter and transmission. |
| | 4. Foaming oil. | 4. (a) Low oil level.<br>(b) Water in oil.<br>(c) Oil line suction leak.<br>(d) Improper oil. |
| | 5. Neutral knockdown valve sticking. | 5. (a) Clean and inspect valve body bore.<br>(b) Inspect valve spring. |
| Low engine speed at converter stall. | 1. Low engine output. | 1. Tune engine and check output. |
| | 2. Stator installed backwards. | |
| | 3. Excessive oil in converter housing. | 3. (a) Converter pump hub seal worn.<br>(b) Input pump seal failure.<br>(c) Excessive input pump wear. |
| | 4. Plugged or restricted accessory drive and torque converter housing drain line. | |
| High oil temperature. | 1. Low transmission sump oil level. | |
| | 2. High transmission sump oil level. | |
| | 3. Foamed oil. | 3. (a) Check oil level.<br>(b) Air leaks in suction lines. |
| | 4. Clogged oil cooler. | |
| | 5. Low converter "IN" pressure. | 5. See low converter "IN" pressure. |

(Continued on next page)

## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| High oil temperature - Cont. | 6. Improper vehicle operation.<br>7. Stator assembled in converter backwards.<br>8. Low oil flow thru converter. | 6. (a) Operate in correct range.<br>(b) Downshift into lower range.<br>(c) Remaining in stall too long.<br>7. (a) Check converter stall.<br>(b) Disassemble converter and check stator.<br>8. Check input pump for excessive wear. |
| Slow or erratic clutch engagement. | 1. Low transmission sump oil level.<br>2. Clogged oil filter screen.<br>3. Foamed oil.<br>4. Improper linkage adjustment.<br>5. Low clutch pressure.<br>6. Clutch pressure regulator valve stuck.<br>7. Neutral knockdown valve sticking.<br>8. Internal oil leaks. | 3. Eliminate air leak into pump suction line.<br>4. Check selector valve positioning.<br>5. See low clutch pressure.<br>6. Inspect valve spring.<br>7. Inspect valve spring.<br>8. (a) Cross check clutches by applying other clutches.<br>(b) Damaged or worn seals in clutch pack.<br>(c) Damaged oil transfer tubes.<br>(d) Damaged or worn shaft seals.<br>(e) Overhaul transmission. |
| High clutch pressure. | 1. Improper main pressure regulator valve operation.<br>2. Stuck converter regulator valve. | 1. (a) Clean and inspect.<br>(b) Inspect spring.<br>(c) Inspect valve bore.<br>2. (a) Inspect spring.<br>(b) Inspect valve bore. |
| Low clutch pressure. | 1. Low transmission sump oil level.<br>2. Clogged oil filter or transmission sump oil screen.<br>3. Foamed oil.<br>4. External oil leaks.<br>5. Improper clutch pressure regulator valve operation.<br>6. Worn input oil pump.<br>7. Neutral knockdown valve. | 3. (a) Eliminate air leaks in suction line.<br>(b) Tighten fittings.<br>(c) Check oil level.<br>5. (a) Clean and inspect.<br>(b) Inspect spring.<br>(c) Check valve body bore.<br>7. (a) Clean and inspect valve body bore.<br>(b) Inspect valve spring. |

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## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Low clutch pressure - Cont. | 8. Internal oil leaks. | 8. (a) Watch for excessive pressure drop in a specific direction or range clutch.<br>(b) Overhaul transmission. |
| High converter "IN" pressure. | 1. Clogged oil cooler.<br>2. Stuck converter regulator valve.<br>3. Stuck lube pressure regulator valve. | 2. Inspect valve spring.<br>3. Inspect valve spring. |
| Low converter "IN" pressure. | 1. Low transmission sump oil level.<br>2. Low clutch pressure.<br>3. External oil leak.<br>4. Converter regulator valve sticking.<br>5. Internal oil leak. | 2. See low clutch pressure.<br>3. Check external lines for leaks.<br>4. Inspect valve spring.<br>5. Overhaul converter. |
| Low lube pressure. | 1. Low oil level.<br>2. Worn input pump.<br>3. Stuck lube pressure regulator valve.<br>4. Internal leaks. | 3. Inspect valve spring.<br>4. Overhaul transmission. |
| High lube pressure. | 1. Stuck lube pressure regulator valve. | 1. Inspect valve spring. |
| Loss of power. | 1. Low engine output.<br>2. Stator assembled backward.<br>3. Low converter "IN" pressure.<br>4. Direction or range selector valves inoperative.<br>5. Improper vehicle operation.<br>6. Parking brake dragging.<br>7. Foaming oil.<br>8. Slipping clutches.<br>9. Vehicle brakes dragging. | 1. See low engine speed at converter stall.<br>2. Disassemble converter and check stator.<br>3. See low converter "IN" pressure.<br>4. (a) Check linkage.<br>(b) Disassemble valve bodies and inspect.<br>5. Operate in proper range for load and terrain.<br>6. Adjust linkage to allow full release.<br>7. (a) Correct oil level.<br>(b) Check for air leak in suction line.<br>(c) Oil used not meeting specifications.<br>8. See low clutch pressure.<br>9. Check brake linkages. |
| Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to the opposite direction. | 1. Failed directional clutch. | 1. Overhaul transmission. |

(Continued on next page)

## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Vehicle drives in one range but stalls when shifted to another range. | 1. Failed range clutch. | 1. Overhaul transmission. |
| All range pressures normal in one direction but all low in opposite direction. | 1. Directional selector valve linkage out of adjustment.<br>2. Internal oil leaks in forward or reverse clutch. | 2. Overhaul transmission. |
| Low clutch pressure in one range clutch in either direction. | 1. Linkage out of adjustment.<br>2. Internal oil leaks in clutch. | 2. Overhaul transmission. |

## SERVICE INFORMATION

### SPECIFICATIONS

Transmission model . . . . . P-2004
Transmission make . . . . . Hough Division of I. H.
Transmission type . . . . . Four speed, constant mesh, full reversing

Ratios:

| RANGE | FORWARD | REVERSE |
|---|---|---|
| 1 | 3.58 | 3.58 |
| 2 | 1.98 | 1.98 |
| 3 | 1.00 | 1.00 |
| 4 | .552 | .552 |

Clutch type . . . . . Multiple disc, pressure balanced, oil cooled
Gearing . . . . . Countershaft design, spur type
Pump make . . . . . Rockford clutch
Oil sump . . . . . Integral
Oil filter . . . . . Replaceable pleated paper, radial fin type element
Filter is remote mounted
Oil screen . . . . . Integral in sump
Oil cooler . . . . . Remote mounted, oil-to-air type heat exchanger
Weight . . . . . 1300 lbs. (approx.)

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## SERVICE INFORMATION

### OPERATING RANGES

Torque converter charging pressure . . . . *50-100 psi

Clutch apply pressure . . . . . **170-200 psi

Lube pressure . . . . . *5-15 psi

Transmission temperature range:
Desired operating . . . . . 180° F.
Maximum operating . . . . . 250° F.

*High idle **At stall

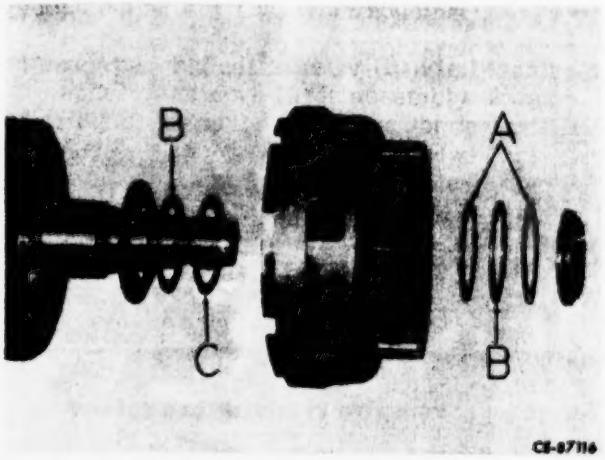


Figure 4-108
Washer Wear Limits.

(a) (Steel Spacer Washer) .073 minimum.

(b) (Bronze Thrust Washer) .087 minimum.

(c) (Thin Steel Spacer Washer) .026 minimum.

NOTE: Washers below these limits should be replaced (Fig. 4-108).

Gear and Cup Assembly Bushing Wear Limits

When measuring the bushing in a clutch gear and cup assembly, the bushing should be measured at the outer edge of the inner diameter of the bushing. The following are the maximum wear limits:

Directional Clutch Shaft Assembly

Bushing in gear and cup assembly has a maximum wear limit of 2.5135 - 2.5155.

Range Clutch Shaft Assemblies

Bushing in gear and cup assembly has a maximum wear limit of 2.5135 - 2.5155.

Replace any of the drive gear and drive cup assembly in which the bushings exceed these limits.

### LUBRICANTS AND CAPACITIES

#### LUBRICANT

Type . . . . . "Dexron® " automatic transmission fluid

#### CAPACITY

Initial fill . . . . . 45 qts.

Refill . . . . . 30 qts.

### TOLERANCES

Output shaft end play . . . . . .005"-.009"

## SERVICE INFORMATION

### SPECIAL TORQUES

| | |
|---|---|
| Strainer flange-to-valve assembly cap screws | 9-10 ft. lbs. |
| Oil strainer mounting cap screws | 33-37 ft. lbs. |
| Oil baffle retaining cap screws | 33-37 ft. lbs. |
| Output yokes retaining nuts | 200 ft. lbs. |
| Small cover-to-housing cap screws | 33-37 ft. lbs. |
| Large cover-to-housing cap screws | 33-37 ft. lbs. |
| Range selector valve retaining cap screws | 19-21 ft. lbs. |
| Directional selector valve retaining cap screws | 33-37 ft. lbs. |
| Lower countershaft cover cap screws | 33-37 ft. lbs. |
| Clutch shaft oil supply covers cap screws | 33-37 ft. lbs. |
| Output shaft front bearing retainer cap screws | 33-37 ft. lbs. |
| Regulator valve retaining cap screws | 33-37 ft. lbs. |
| Input yoke retaining cap screws | 33-37 ft. lbs. |
| Output shaft rear bearing retainer: | |
| Preliminary torque | 25-30 in. lbs. |
| Secondary torque | 50 in. lbs. |
| Final torque | 33-37 ft. lbs. |
| Transmission mounting bolts: | |
| Mounting bracket-to-transmission | 155-165 ft. lbs. |
| Mounting bracket-to-frame | 300-330 ft. lbs. |

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## SERVICE INFORMATION

### CLUTCH PLATE INSTALLATION

**NO. OF CLUTCH PLATES ON EITHER SIDE OF BACKING PLATES**

| | SIDE "A" | | SIDE "B" | |
|---|---|---|---|---|
| | Bronze | Steel | Bronze | Steel |
| fwd. & rev. | 11 | 10 | 11 | 10 |
| 1st & 3rd | 11 | 10 | 11 | 10 |
| 2nd & 4th | 11 | 10 | 11 | 10 |

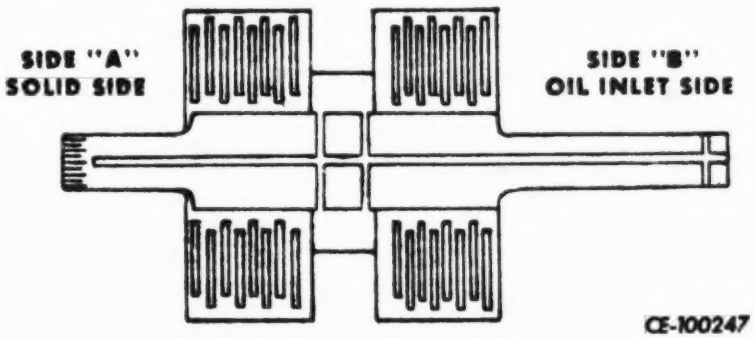


Figure 4-109

## SPECIAL TOOLS

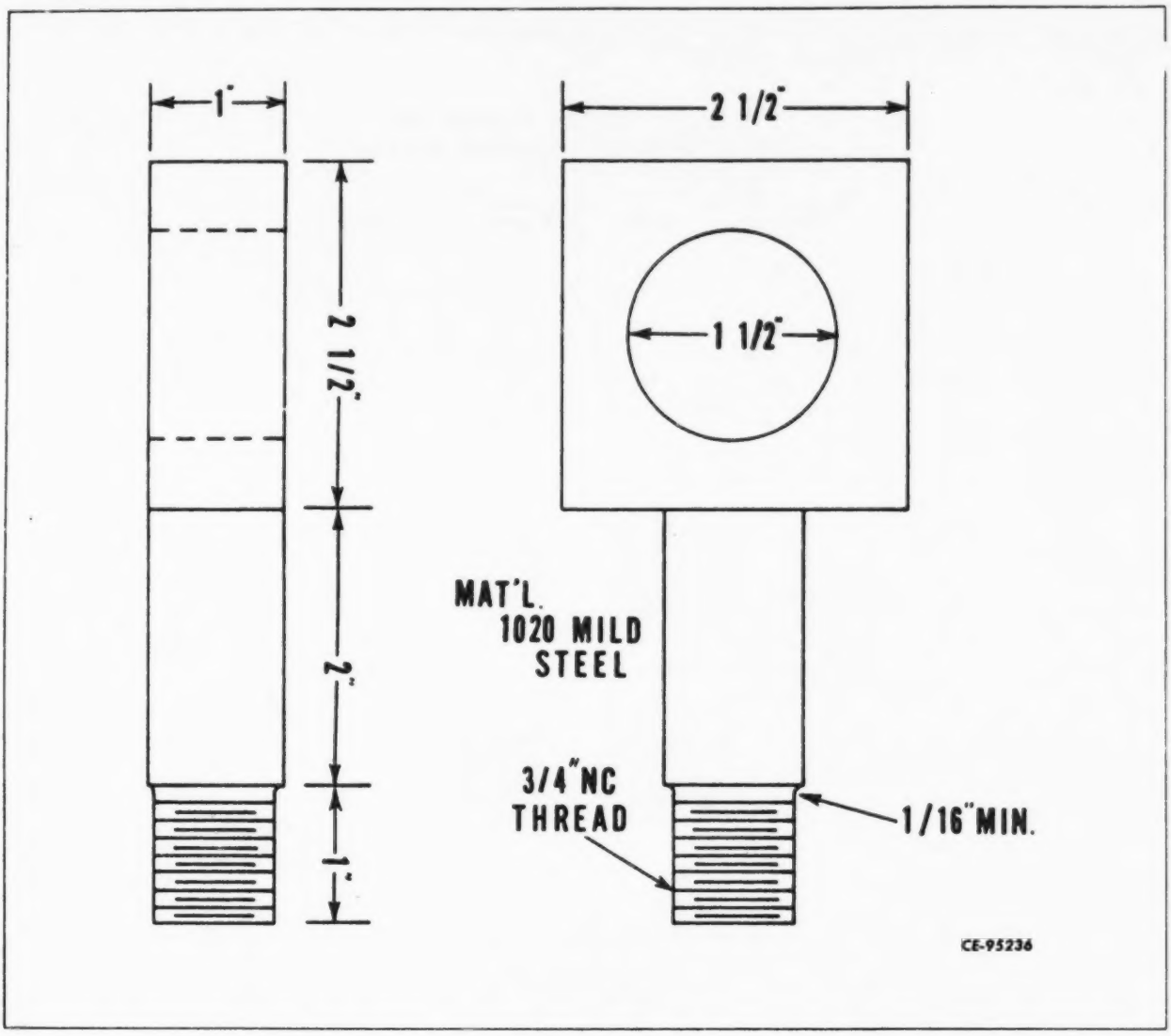


Figure 4-110
Lifting Eye.

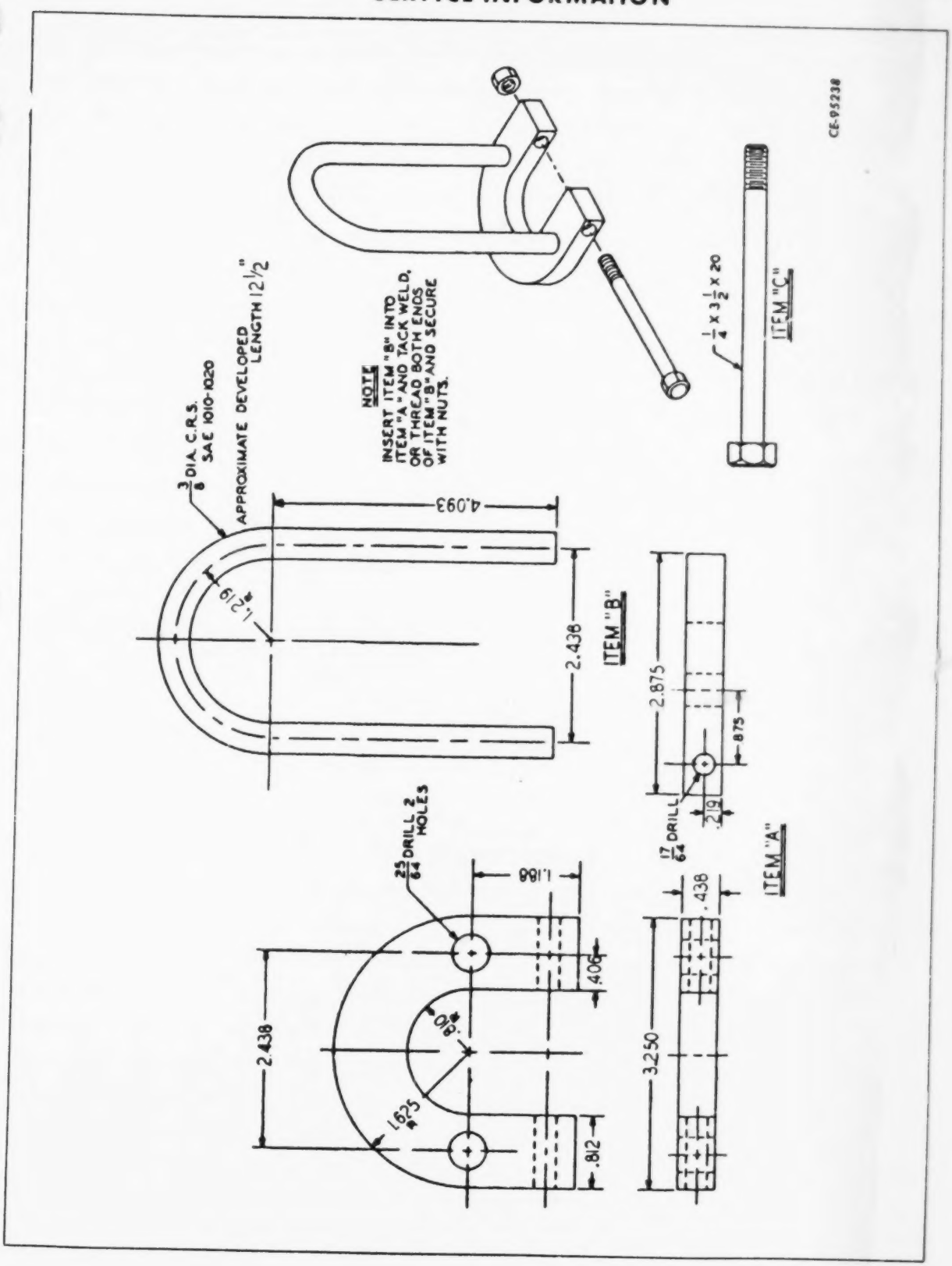


Figure 4-111
Clutch Holding Tool.

## SPECIAL TOOLS - Continued

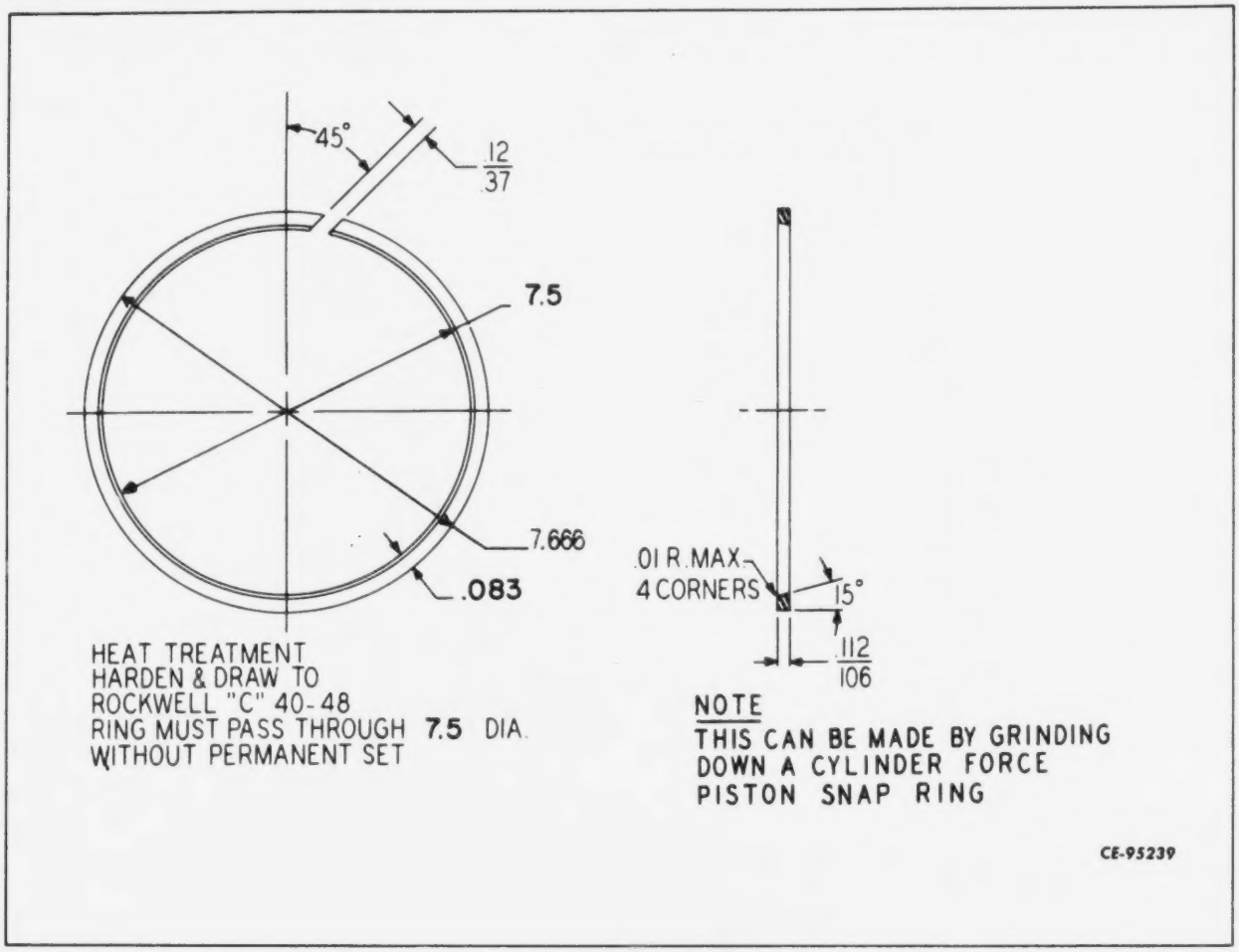


Figure 4-112
Snap Ring Groove Filler.

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
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# SECTION V
# DRIVE SHAFTS

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SECTION V DRIVE SHAFTS


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## DESCRIPTION

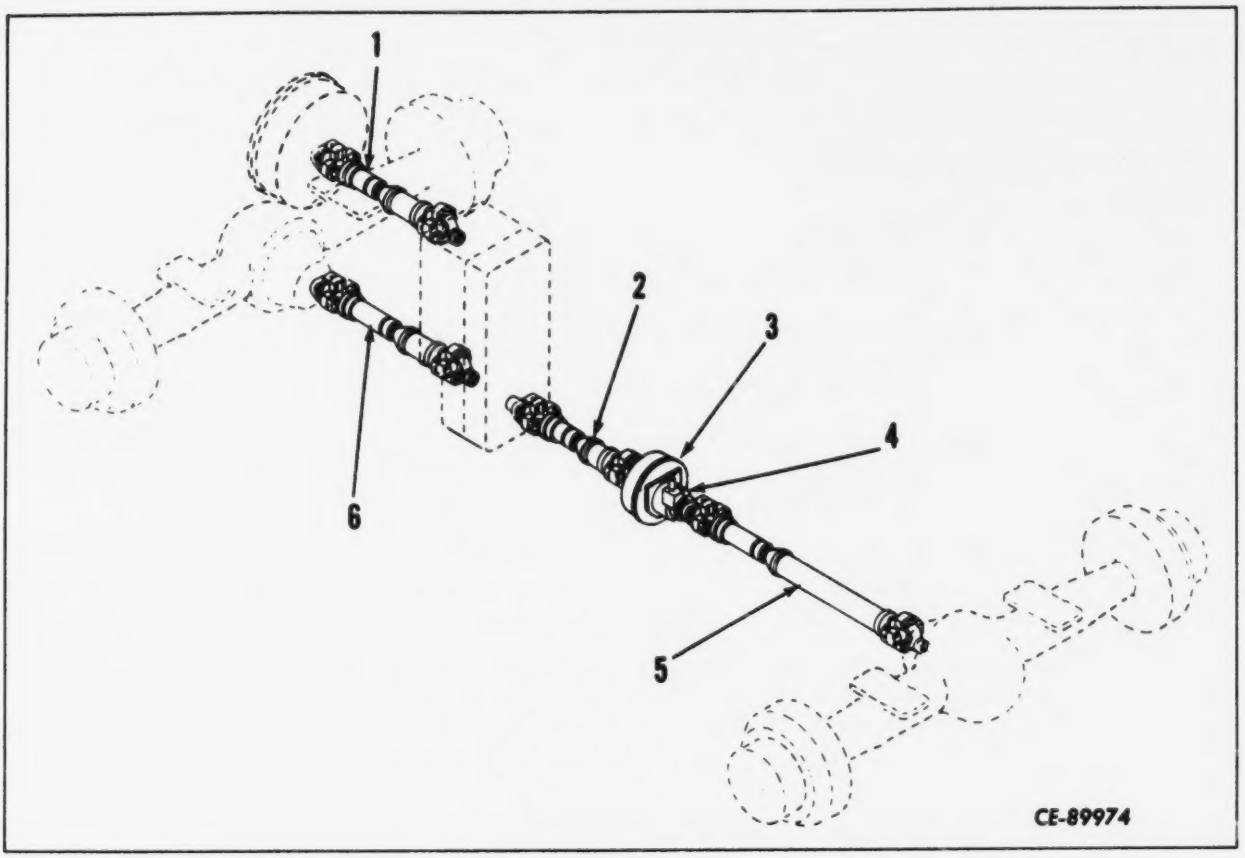


Figure 5-1
Drive Shafts.

1. Drive shaft, torque converter-to-transmission.
2. Drive shaft, transmission-to-transfer drive.
3. Parking brake assembly.
4. Transfer drive assembly.
5. Drive shaft, transfer drive-to-front differential.
6. Drive shaft, transmission-to-rear differential.

# DRIVE SHAFTS

## DESCRIPTION

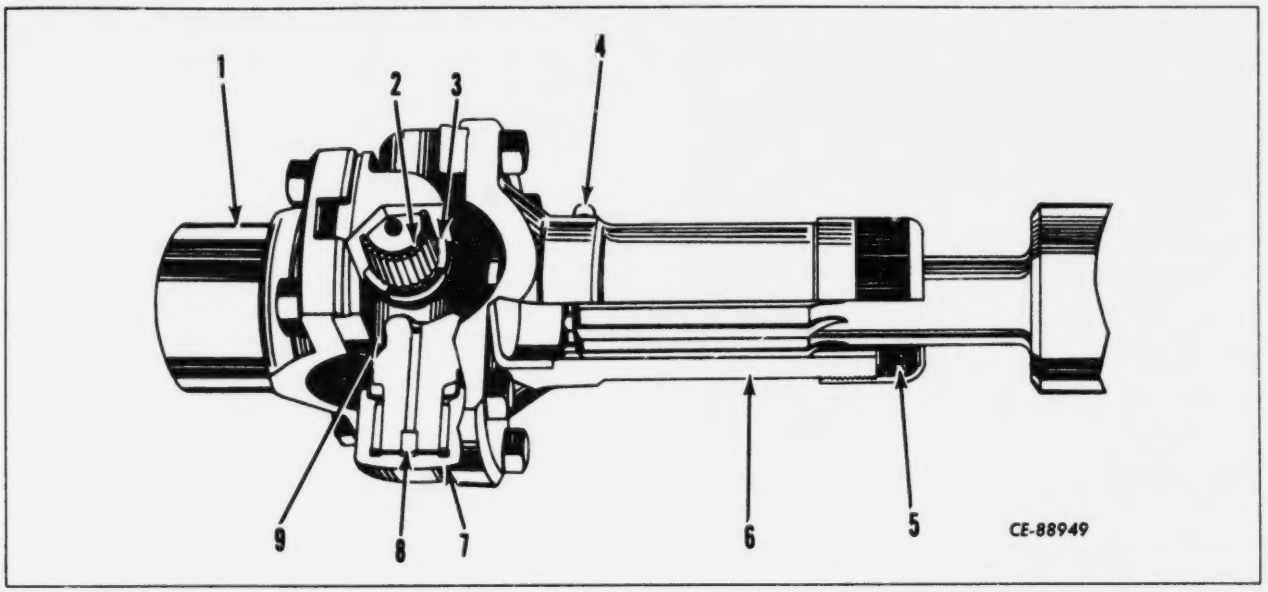


Figure 5-2
Universal Joint.

1. Yoke.
2. Roller bearing.
3. Grease seal.
4. Grease fitting.
5. Grease seal.
6. Slip yoke.
7. Bearing cap.
8. Lube channel.
9. Spider.

## DRIVE SHAFTS

The purpose of the drive shafts is to transmit power. All the drive shafts on the tractor are similar in construction. (Fig. 5-2.) There is a universal joint located at each end of the shaft to permit pivoting in all directions and accommodate any misalignment. A slip joint is provided to allow the shaft to telescope, to compensate for changes in the distance between the connected components. During normal operation, the rear axle undergoes considerable axial movement due to surface irregularities and varying axle loads. Each time these conditions are encountered, a proportional change in the overall length of the drive shaft occurs. The slip joint accomodates these variations by telescoping. This eliminates the forces of tension that would be present in a shaft not so equipped.

## TRANSFER DRIVE

The transfer drive (Fig. 5-3) transmits power from the transmission to the front differential across the tractor articulation point. The transfer drive consists of a shaft supported by two roller bearing assemblies, held in a lubricant filled housing. A yoke is attached to each end of the shaft. The parking brake assembly is mounted on the rear of the transfer drive.

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## DESCRIPTION

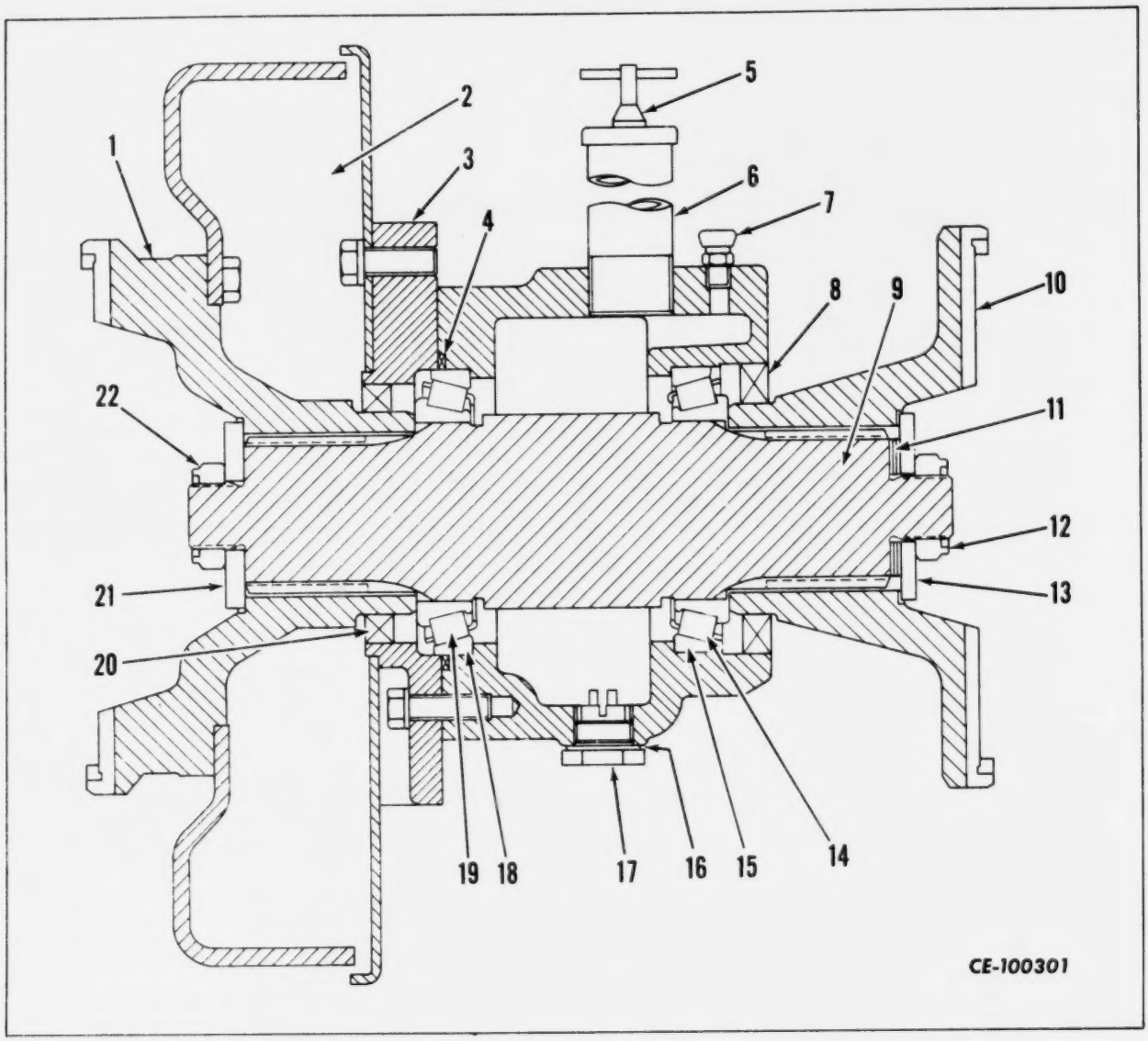


Figure 5-3
Transfer Drive.

1. Rear yoke and drum assembly.
2. Parking brake assembly.
3. Cover.
4. "O" ring.
5. Dipstick.
6. Filler tube.
7. Breather.
8. Seal.
9. Shaft.
10. Front yoke.
11. Shims (selective).
12. Lock nut.
13. Retainer.
14. Bearing cone.
15. Bearing cup.
16. Washer.
17. Drain plug.
18. Bearing cup.
19. Bearing cone.
20. Seal.
21. Retainer.
22. Lock nut.

## PREVENTIVE MAINTENANCE

The drive line components on the tractor are subject to constant strain during operation. It is important, therefore, that they be properly maintained. Listed below are recommended maintenance procedures.

### DRIVE SHAFTS

After every 1000 hours of tractor operation and after overhaul, apply the proper lubricant to all drive shaft universal joints and slip joints (Fig. 5-4). Refer to "SPECIFICATIONS" for type of lubricant.

### TRANSFER DRIVE

LEVEL CHECK - Every 100 hours of tractor operation, check the oil level in the transfer drive housing. Remove the filler tube cap (Fig. 5-5) and check the oil level. The level should

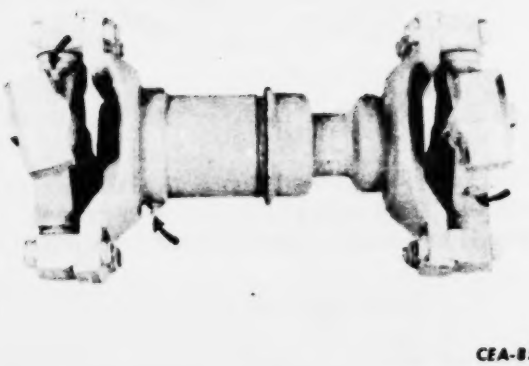


Figure 5-4

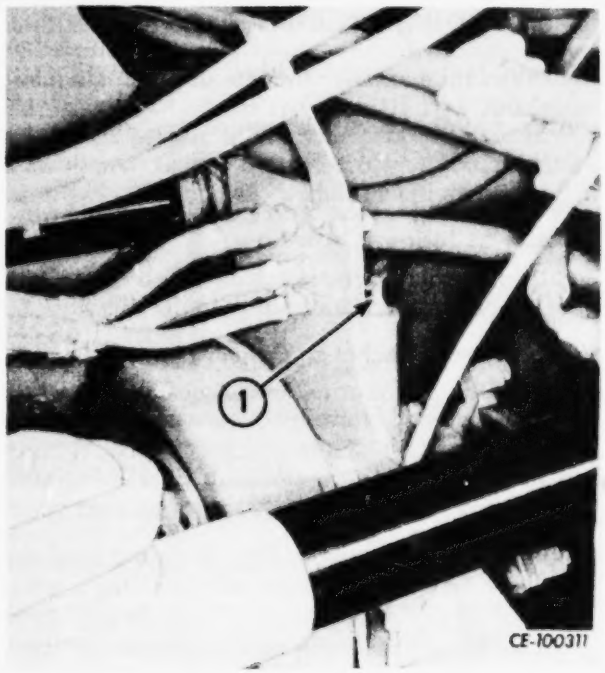


Figure 5-5

be kept at the full mark at all times. Should make-up fluid be needed, add the type oil recommended in "SPECIFICATIONS."

OIL CHANGE - Every 1000 hours of tractor operation, the transfer drive should be drained and refilled with fresh oil. Remove the filler tube cap (5, Fig. 5-3) and the drain plug (12). After all the oil has drained, install the drain plug and fill the housing to the full mark on the dipstick, with the type lubricant recommended in "LUBRICANTS AND CAPACITIES."

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DRIVE SHAFTS

GENERAL

All drive shafts on the tractor are similar and are serviced in the same manner.

Prepare the tractor for removal of the drive shafts as follows:

a. Park tractor on a level surface.

b. Lower bucket to ground level.

c. Securely block wheels to prevent tractor from rolling.

REMOVAL

Remove cap screws (1, Fig. 5-6) and lock nuts (2) from each end of drive shaft. Using a small pry bar, apply leverage to telescope slip yoke (4) inward. Remove drive shaft from tractor.

NOTE: Bearing caps (3) may stick in grooves in yoke. Tap them at an angle with a soft hammer to unseat.

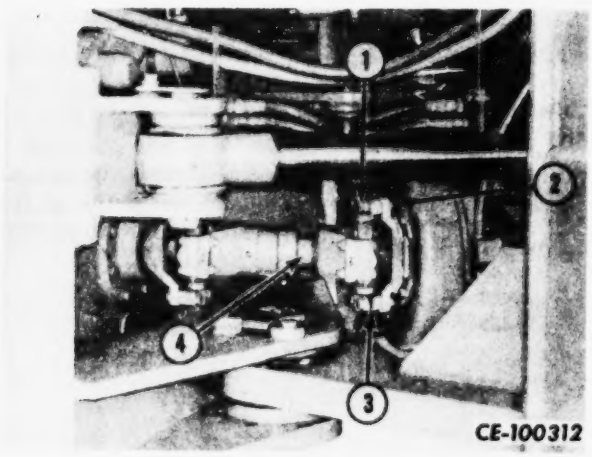


Figure 5-6

DISASSEMBLY

Place drive shaft on a clean work bench.

Remove cap screws (1, Fig. 5-7) and lock nuts (2) that secure spider and bearing assembly (3) to yoke (4).

NOTE: Bearing caps (5) may stick in grooves in yoke. Tap them at an angle with a soft hammer to unseat.

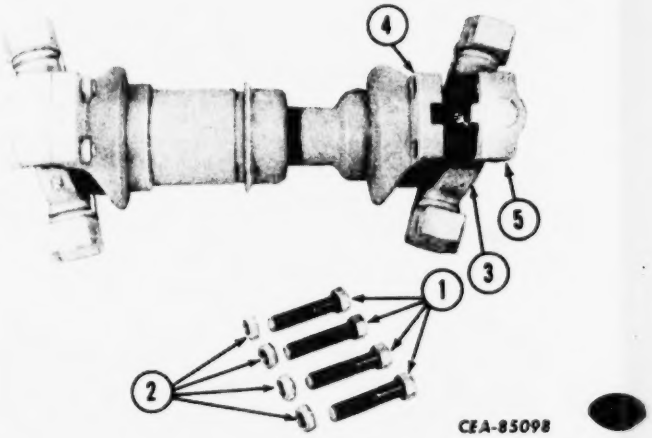


Figure 5-7

Cut strap (1, Fig. 5-8) that holds bearing assemblies (2) on spider (3). Remove grease seals (4) and bearing assemblies from spider.

(Continued on next page)

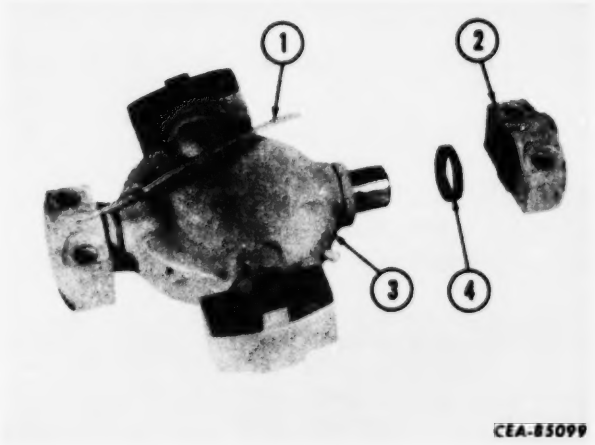


Figure 5-8

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DRIVE SHAFTS - Continued

DISASSEMBLY - Continued

Punch mark slip yoke (1, Fig. 5-9) and splined shaft (2) so they will be assembled with the same alignment.

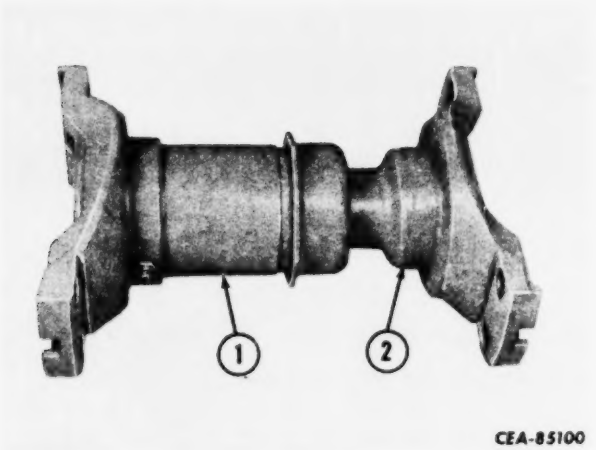


Figure 5-9

Unscrew packing retainer (1, Fig. 5-10) and slide it back on splined shaft. Remove slip yoke (4), packing retainer washers (2) and packing (3).

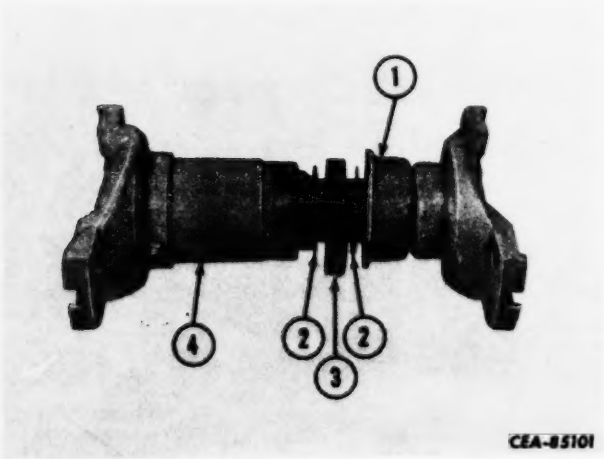


Figure 5-10

CLEANING AND INSPECTION

Clean all parts in solvent. Remove all burrs and rough spots from the yoke flanges and from slip joint splines. Use a fine tooth file or an India stone. Do not disassemble the bearing assemblies. Clean them with a brush and dry with compressed air.

Inspect the drive shaft for signs of torsional fractures or other indications of impending failure.

Parts that are to be assembled immediately should be coated with light oil to prevent corrosion. If parts are to be stored, coat them with a good grade rust preventive, and wrap them in paper treated to prevent corrosion.

Replace all seals and packings.

Place the bearing assemblies on the spider and check for wear. If they are worn, replace the complete spider and bearing assembly.

ASSEMBLY

Place packing retainer (1, Fig. 5-11), packing (3), and packing retainer washers (2) on splined shaft (4) as shown. Use a new packing. Coat shaft splines liberally with chassis grease.

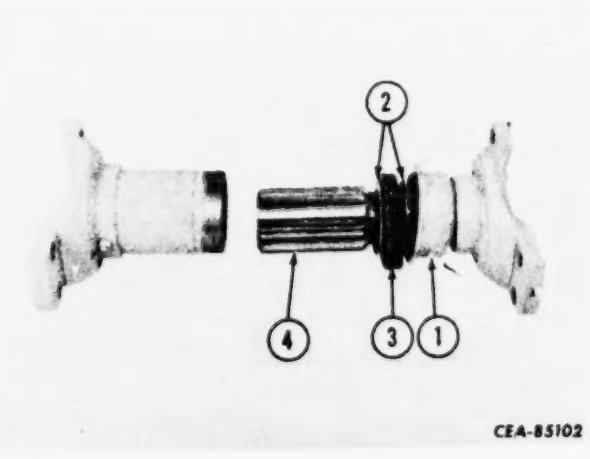


Figure 5-11

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Slide slip yoke (2, Fig. 5-12) onto splined shaft (1) aligning punch marks made during disassembly. Screw packing retainer (3) onto slip yoke and tighten it enough to avoid leakage when shaft is greased.

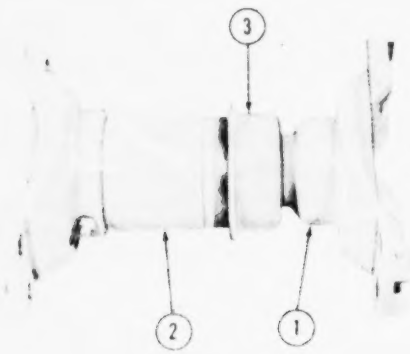


Figure 5-12

Install two opposite bearing assemblies (1, Fig. 5-13) on spider (2). Install spider assembly in yoke by inserting lug on bearing cap into groove in yoke (3) as shown. Tap opposite bearing cap at an angle to seat spider and bearing assembly.

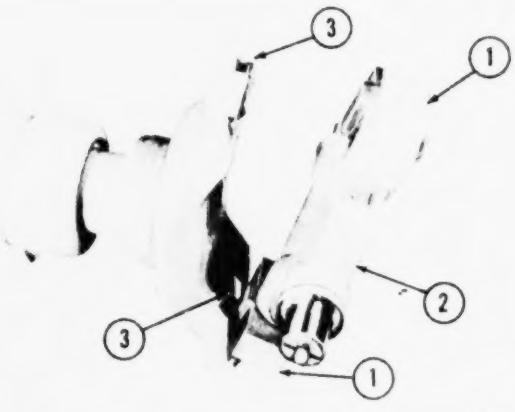


Figure 5-13

Install cap screws (1, Fig. 5-14) and lock nuts (2) in bearing caps (3). Torque cap screws and lock nuts. Refer to "SPECIAL TORQUES" in this section.

NOTE: Use new lock nuts (2) when assembling drive shaft.

Torque: _____

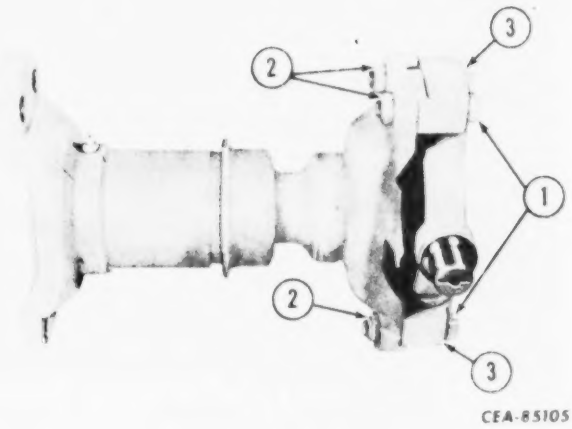


Figure 5-14

Install remaining two bearing assemblies on the spider and wire as shown. This will hold bearing caps on spider while drive shaft is installed on tractor (Fig. 5-15).

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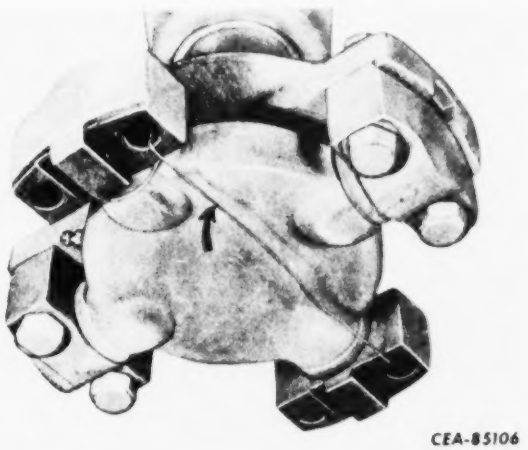


Figure 5-15

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### DRIVE SHAFTS - Continued

#### INSTALLATION

Install drive shaft in tractor. Be certain slip joint end of shaft is located as it was at removal. Fit bearing caps securely in grooves in mounting yokes. Install two cap screws (1, Fig. 5-16) and nuts (2) in bearing cap holes that are not wired. Tighten just enough to hold caps in place. Remove wire from the other two holes and install cap screws and lock nuts.

NOTE: Use new lock nuts (2) when assembling drive shaft.

Torque cap screws and lock nuts. Refer to "SPECIAL TORQUES" in this section. Remove pipe plug from slip yoke and apply the type grease specified in "LUBRICANTS AND CAPACITIES." Install the pipe plug. Apply grease to universal joint fittings at each end of shaft.

Torque:_____

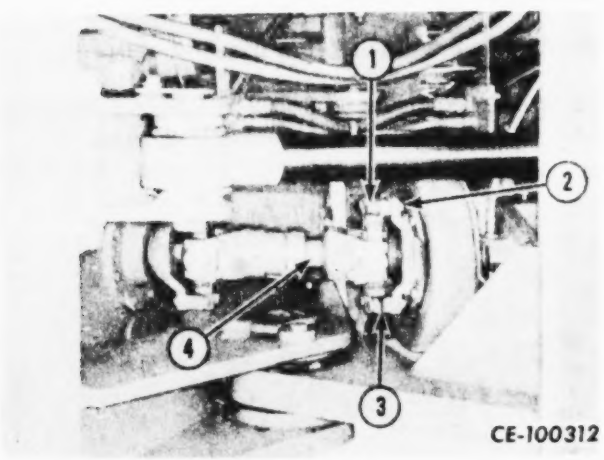


Figure 5-16

### TRANSFER DRIVE

#### GENERAL

Prepare tractor for removal of transfer drive as follows:

a. Park tractor on a level surface.

b. Install safety pins to lock tractor halves in a full turn position. Refer to Section I, "CHASSIS" for safety pin installation instructions.

c. Block tractor wheels to prevent tractor from rolling.

#### REMOVAL

Remove dipstick (Fig. 5-5) and drain plug (Fig. 5-17) from transfer drive housing. Allow all oil to drain from housing. Install dipstick and drain plug.

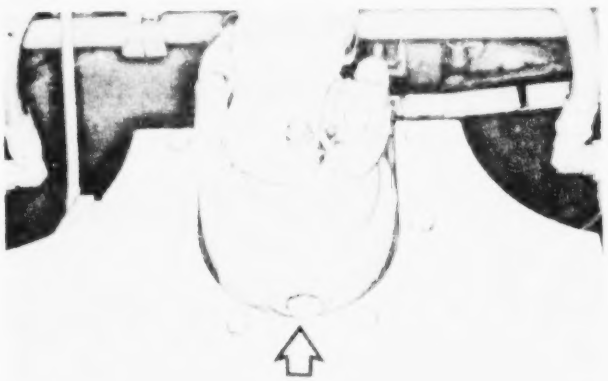

Figure 5-17

Remove cap screws (1, Fig. 5-18) that secure drive shafts (3) to transfer drive yokes (4). Remove drive shafts from yokes.

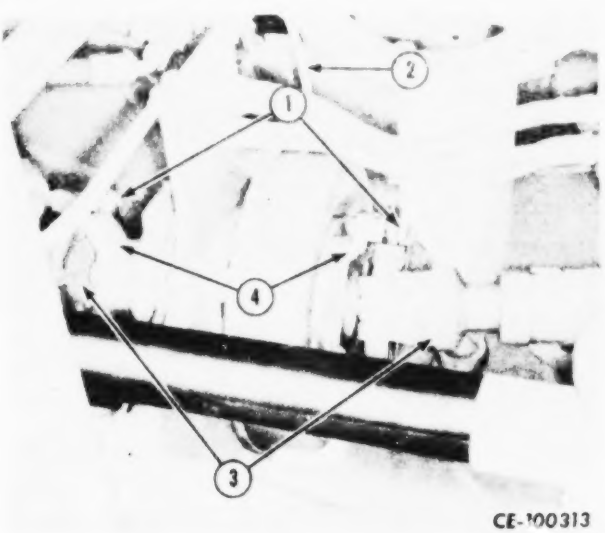


Figure 5-18

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Disconnect parking brake linkage (2) from operating cam lever.

Remove cap screws (2, Fig. 5-19) and lock washers that secure transfer drive (1) to front frame. Remove transfer drive from rear side of frame crossmember to which it mounts.

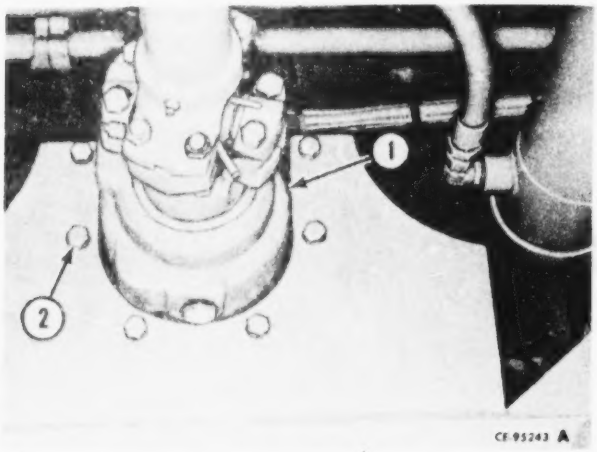


Figure 5-19

DISASSEMBLY

Place transfer drive on a clean work bench for disassembly.

Remove lock nut (1, Fig. 5-20), retainer (2), and seal washer (3, where used) that secure yoke and drum assembly (4) to shaft (5).

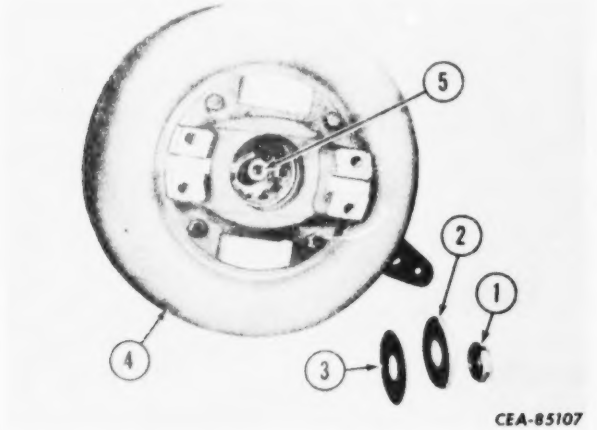


Figure 5-20

Remove yoke and drum assembly.

Using a brake spring pliers, remove brake springs (1, Fig. 5-21) from brake shoes (2) as shown.

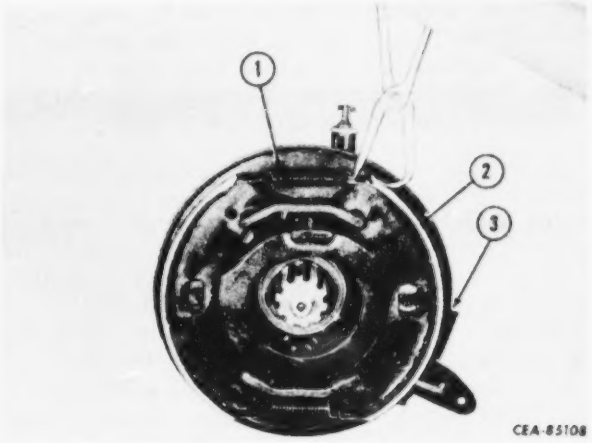


Figure 5-21

Remove brake shoes from backing plate (3).

Remove operating cam lever (2, Fig. 5-22) and roller (1) from pawls (3) on backing plate.

(Continued on next page)

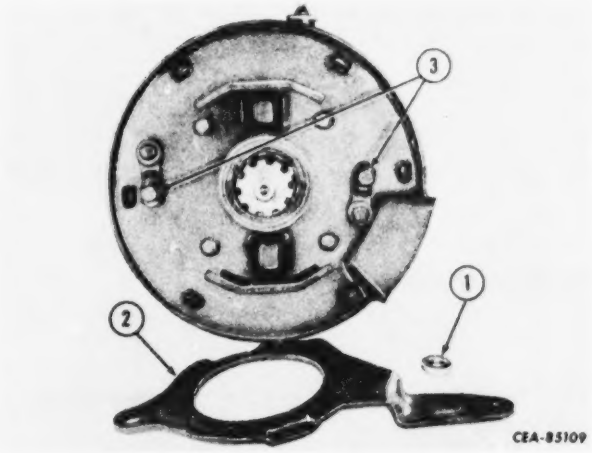


Figure 5-22

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### TRANSFER DRIVE - Continued

DISASSEMBLY - Continued

Remove cap screws and lock washers (1, Fig. 5-23) that secure backing plate (2) to transfer drive housing.

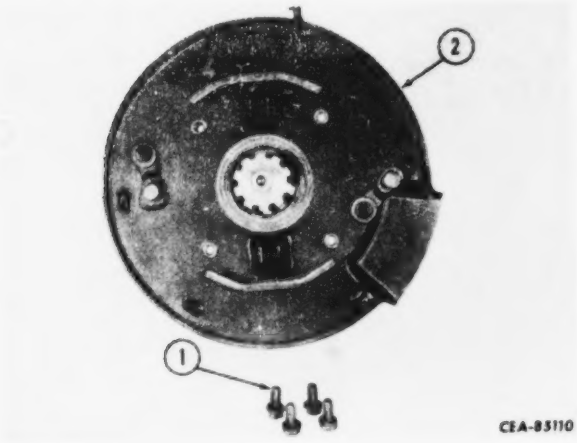


Figure 5-23

Remove lock nut (1, Fig. 5-24), retainer (2), and shim pack (3) that secure output yoke (4) to shaft (5). Remove yoke.

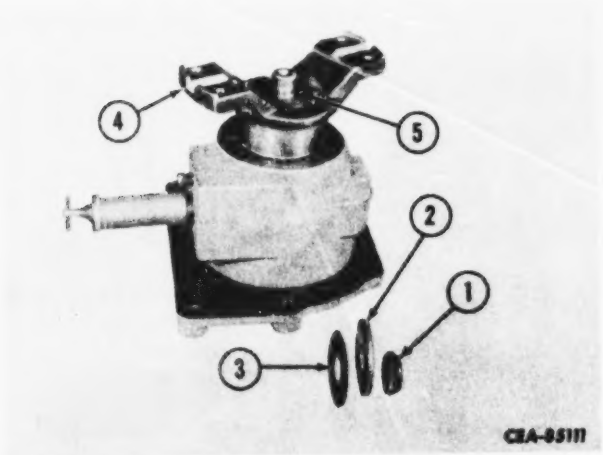


Figure 5-24

NOTE: Early model transfer drives used a sealing washer in place of shim pack (3).

Tie shims together.

Remove drain plug (1, Fig. 5-25) from housing.

Remove cap screws (2) that secure cover (3) to housing (4). Remove cover and cover "O" ring.

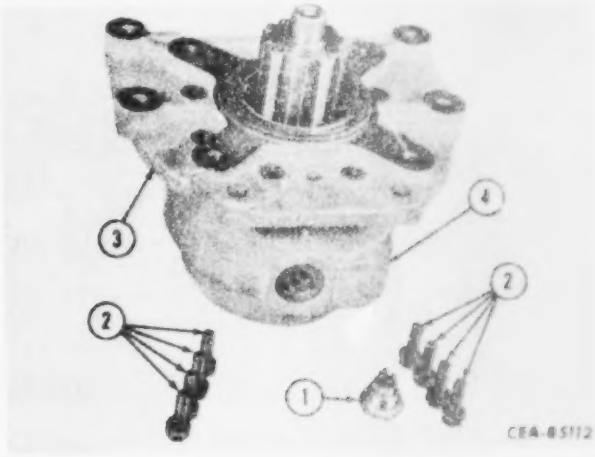


Figure 5-25

Press oil seal (1, Fig. 5-26) out of cover (2). Discard oil seal.

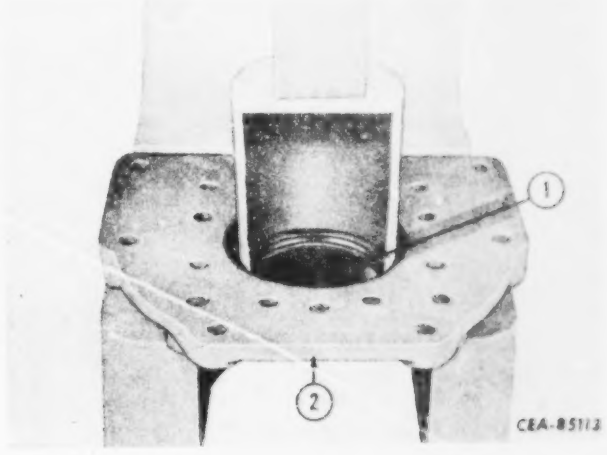


Figure 5-26

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Using a suitable tool, press shaft (1, Fig. 5-27) from housing (2). Press on output end of shaft.

NOTE: Do not press on threaded end of shaft. Use a suitable sleeve.

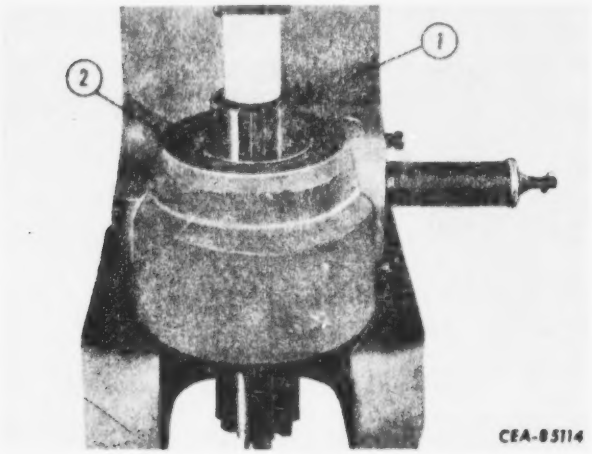


Figure 5-27

Bearing cone (1, Fig. 5-28) will come out with shaft.

If replacement is required, use flat head drift to drive bearing cup (2) from housing.

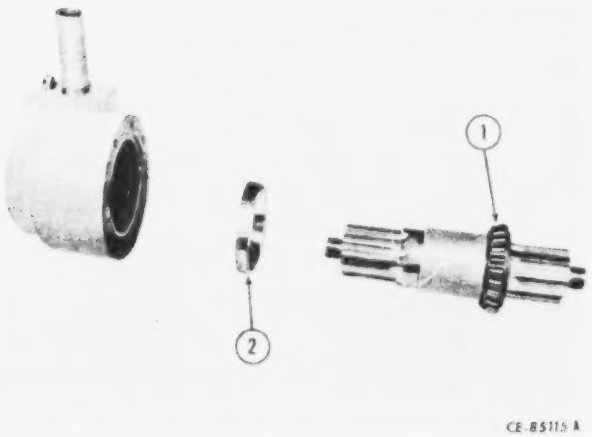


Figure 5-28

Press shaft (1, Fig. 5-29) out of bearing cone (2) as shown.

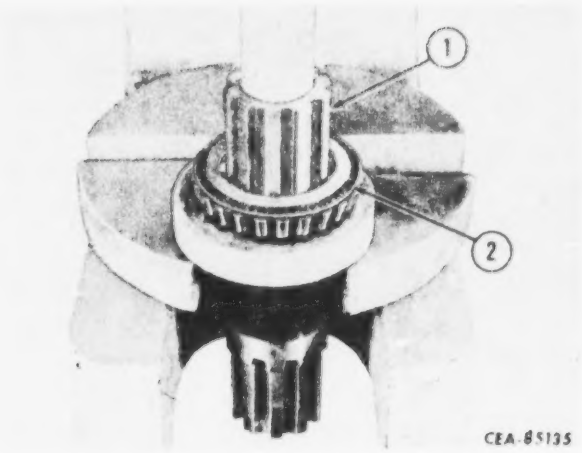


Figure 5-29

Using a flat head drift, drive oil seal (1, Fig. 5-30), bearing cone (2), and bearing cup (3) from housing output end (4). Discard oil seal.

(Continued on next page)

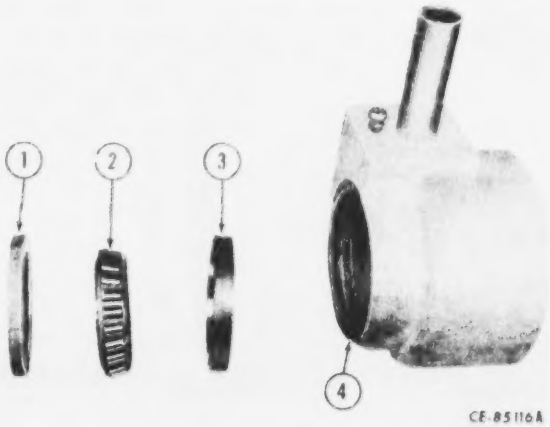


Figure 5-30

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### TRANSFER DRIVE - Continued

DISASSEMBLY - Continued

Remove breather (1, Fig. 5-31) and filler tube (2) from housing if they are damaged.

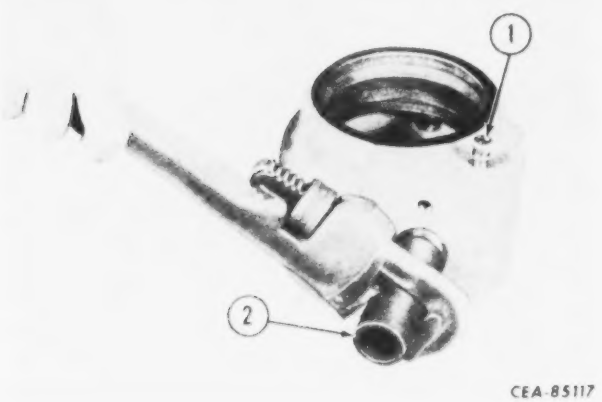


Figure 5-31

CLEANING AND INSPECTION

Clean and inspect all parts as follows:

a. Clean all parts thoroughly in solvent. Use compressed air to dry parts.

CAUTION: NEVER dry bearings by spinning with compressed air.

b. Inspect all bearing cups and cones. Be sure that the bearings rotate freely and smoothly. Replace any bearings that are worn or damaged in any way.

c. Inspect transfer drive shaft for signs of wear or ridging. Replace if worn or damaged in any way.

d. Inspect transfer drive housing for wear or damage. Replace if found defective.

e. Replace all oil seals, seal washers, and "O" rings.

f. Parts that are to be assembled immediately should be dipped in light oil to prevent corrosion. If any parts are to be stored for any length of time, they should be coated with a good grade rust preventive and wrapped in paper treated to prevent corrosion.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

Coat threads on the breather and filler tube with Mar-Seal or a comparable sealant and install them in housing.

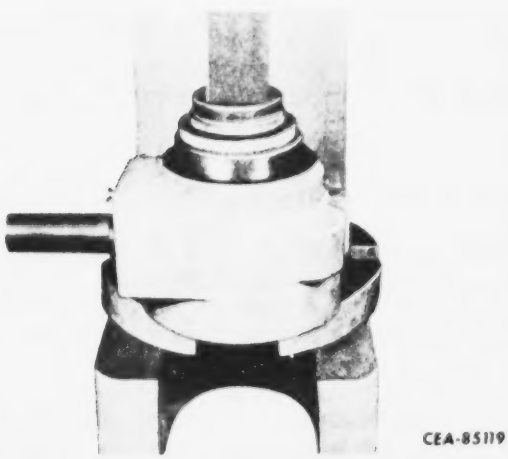


Figure 5-32

Using a suitable tool, press output and input bearing cups into housing as shown in Fig. 5-32. Press until cups bottom securely against housing shoulders.

Position transfer drive shaft (4, Fig. 5-33) in an arbor press, input side up. Position bearing (3) on shaft. Install output yoke (2).



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

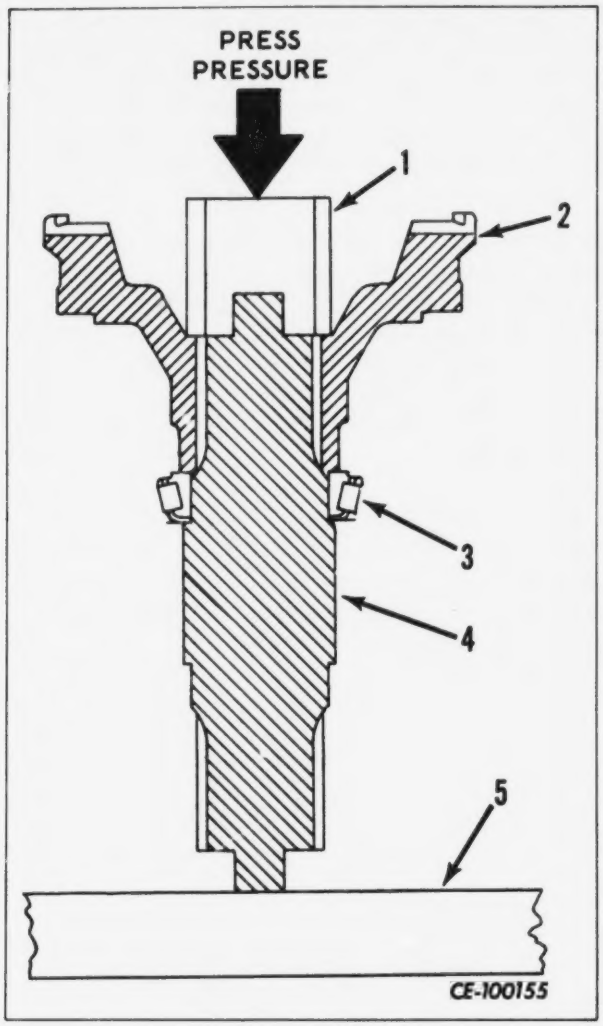


Figure 5-33

NOTE: For ease in handling the use of the output yoke is recommended when pressing bearing on shaft.

Using a suitable sleeve (1) press bearing on shaft. Continue press pressure until yokes bottom on end of splines. Bearing (3) is now correctly positioned on shaft. Remove yoke (2) from shaft.

Install shaft and bearing assembly in drive housing.

Coat the O. D. of a new oil seal (1, Fig. 5-34) with Mar-Seal or a comparable sealant and press seal (1) into outside face of cover (2). Spring loaded lip of seal must face in toward center of housing. Press until seal is flush with face of cover.

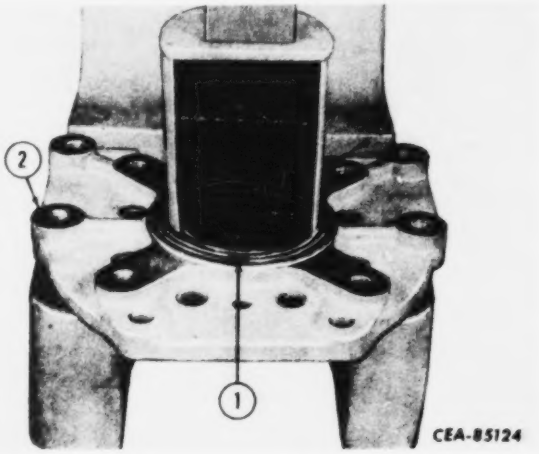


Figure 5-34

Place a new cover "O" ring in groove in housing.

Install cover (3, Fig. 5-25) on housing and secure with cap screws (2). Torque cap screws (Refer to "SPECIAL TORQUES").

Torque:_____

Install parking brake backing plate (2, Fig. 5-23) on transfer drive and secure with cap screws and lock washers (1). Torque cap screws (Refer to "SPECIAL TORQUES").

Torque:_____

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### TRANSFER DRIVE - Continued

ASSEMBLY - Continued

Place roller (1, Fig. 5-35) on pawl (3) on backing plate. Place operating cam lever (2) on pawl (4) and under roller (1).

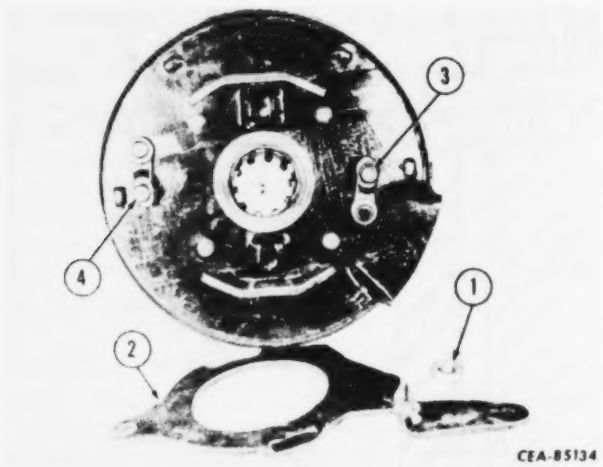


Figure 5-35

Install brake shoes (2, Fig. 5-21) on backing plate (3). Install brake springs (1) with a brake spring pliers as shown. Be sure springs are installed in rear holes.

Place yoke and drum assembly (4, Fig. 5-20) on shaft (5) after lubricating seal lip and seal contact surface of yoke with clean, new transfer drive lubricant. Place a new seal washer (3) (where used) on shaft. Install retainer (2) and new lock nut (1). Torque lock nut (Refer to "SPECIAL TORQUES").

Torque:_____

Position transfer drive assembly, input yoke down, in arbor press (Fig. 5-36). Use a suitable spacer (4) between yoke retainer and press table. Press pressure should be on spacer not yoke ears.

Position bearing (3) on shaft (6) and slide output yoke (7) on shaft splines. Position a suitable adapter (1) on yoke and carefully, using yoke as a driver, press bearing cone into cup.

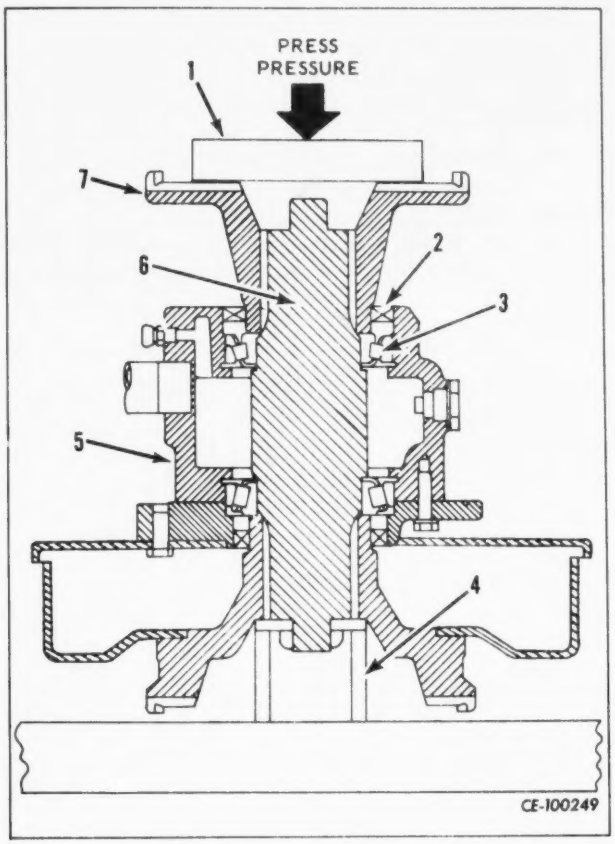


Figure 5-36

Pressure on yoke (7) must be applied slowly and carefully. Rotate housing (5) while pressing bearing into position. As soon as bearings bind slightly during rotation, stop press pressure.

Measure distance from large diameter face of shaft (2, Fig. 5-37) to retainer contact surface (1) on yoke. This is Dimension "A."

NOTE: This measurement may be made by drilling a hole in the yoke retainer (2, Fig. 5-24) large enough to accept the shaft of a depth micrometer (4, Fig. 5-37). Position retainer (3) on shaft and measure distance from top of retainer to large diameter face on shaft. (Dimension "B.") "Mike" the thickness of the retainer (Dimension "C") and subtract this from Dimension "B." The remainder is Dimension "A."

Dimension "A" is the thickness of the required shim pack. Add to this pack sufficient shims to



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

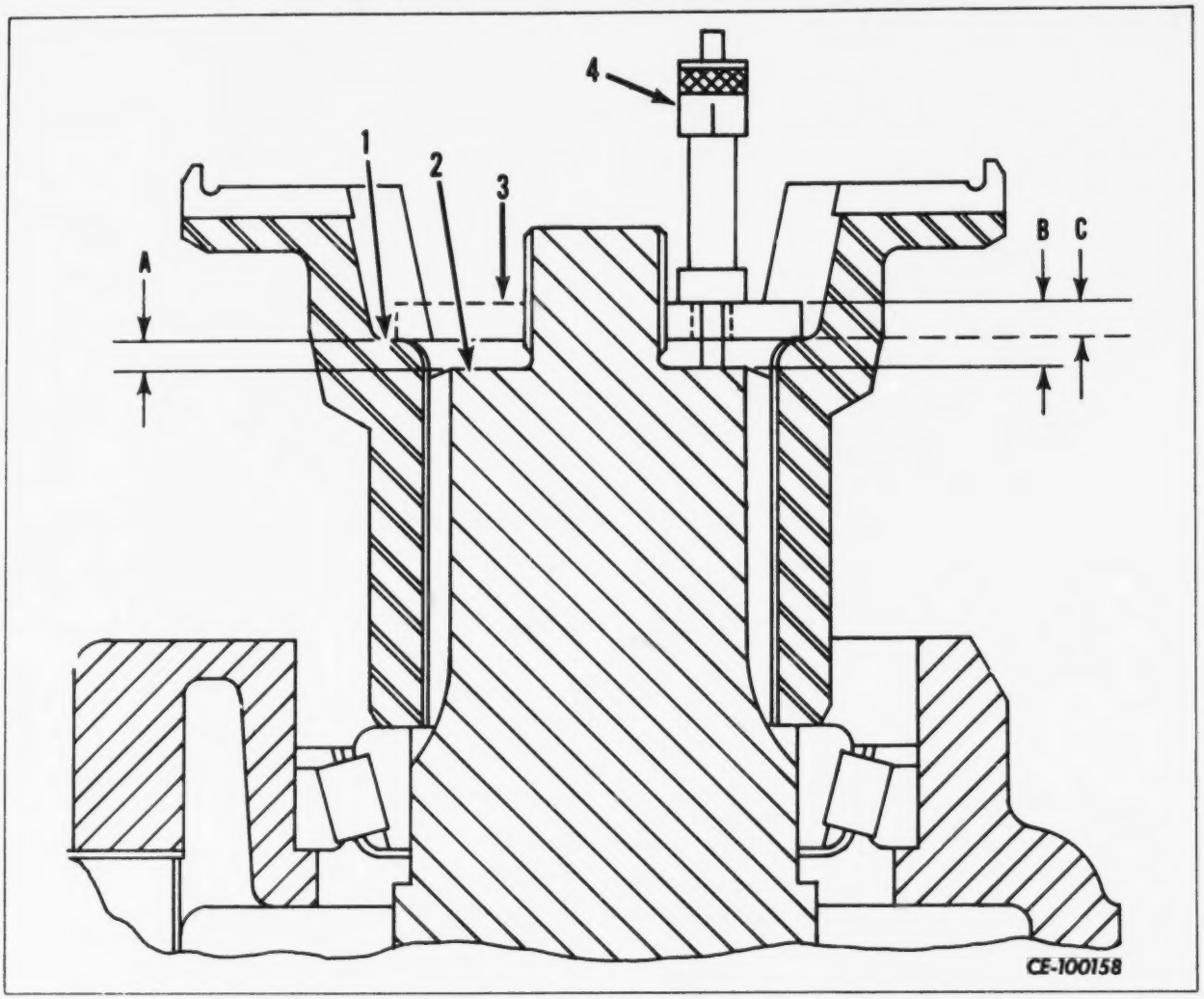


Figure 5-37

produce the recommended shaft end play (Refer to "SPECIFICATIONS").

End Play:_____

Install shim pack, yoke retainer and new lock nut. Tighten lock nut to recommended torque (Refer to "SPECIAL TORQUES").

Torque:_____

Using a new gasket, install the drain plug (1, Fig. 5-25) in the housing and tighten securely.

### INSTALLATION

Install transfer drive in tractor frame cross-member. Install cap screws (2, Fig. 5-19), and lock washers. Torque cap screws (Refer to "SPECIAL TORQUES").

Torque:_____

Install drive shafts (3, Fig. 5-18) in transfer drive yokes (4) and secure with cap screws (1). Torque cap screws (Refer to "SPECIAL TORQUES").

Torque:_____

Attach parking brake linkage (2) to operating cam lever.

Fill transfer drive housing to full mark on dip-stick with type oil recommended in "LUBRICANTS AND CAPACITIES."

## TROUBLE SHOOTING

### GENERAL

Drive line failures are usually indicated by noise or vibrations. The noise or vibration may come and go as different speeds are reached.

The trouble shooting chart below will help to identify and isolate the cause of trouble in the drive line components.

Inspect the areas of the tractor around the drive shafts for signs of grease that may have been thrown out by the universal joint or slip joints. If grease is found in the area of the universal joints, replace the grease seals on the spider and bearing assemblies. If grease is found in the area of the slip joint, tighten the slip joint seal retainer. If the leakage continues, replace the slip joint grease seal.

Check the drive yokes on the torque converter, transmission, transfer drive and differentials for looseness. If the yokes can be moved back and forth any appreciable amount, disconnect the drive shaft at the yoke and tighten the yoke mounting nuts or cap screws. Torque the nuts or cap screws as directed under "SPECIAL TORQUES." Before tightening the yoke, check for backlash. Backlash indicates that the yoke splines are worn and the yoke should be replaced.

Check the universal joint spider and bearing assemblies for excessive play. If excessive play is found the spider and bearing assemblies on the drive shaft should be replaced as described under "DISASSEMBLY, INSPECTION AND ASSEMBLY."

### TROUBLE SHOOTING CHART

| COMPLAINT | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| | DRIVE SHAFTS | |
| Noise. | 1. Lack of lubricant. | 1. Check grease seals in slip joints and universals. |
| | 2. Back lash due to worn universal spider or bearings. | 2. Replace spider and bearing assembly. |
| | 3. Mounting yokes loose. | 3. Tighten yoke mounting nuts or cap screws. |
| | 4. Worn splines in drive shaft slip joints. | 4. Replace drive shaft. |
| Vibration. | 1. Drive shaft sprung or bent. | 1. Replace drive shaft. |
| | 2. Universal joint bearings not seated properly. | 2. Correct or replace bearing and spider. |
| | 3. Mounting yokes loose. | 3. Tighten mounting nuts or cap screws. |
| | TRANSFER DRIVE | |
| Noise. | 1. Lubricant level too low or incorrect lubricant. | 1. Fill to FULL mark on dipstick with type lubricant recommended in "LUBRICANTS AND CAPACITIES." |
| | 2. Bearings scored or damaged. | 2. Replace bearings. |
| Loss of Lubricant. | 1. Lubricant level too high. | 1. Drain to correct level. |
| | 2. Lubricant foams excessively. | 2. Drain and fill with correct type lubricant. Refer to "LUBRICANTS AND CAPACITIES." |
| | 3. Worn or broken seals. | 3. Replace seals. |

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## SERVICE INFORMATION

### SPECIFICATIONS

DRIVE SHAFT - TORQUE CONVERTER TO TRANSMISSION

| | |
|---|---|
| Make | Rockwell Standard Corporation |
| Model | 62NLS28-11 |
| Length compressed (bearing center to bearing center) | 14.375 in. |
| Length extended (bearing center to bearing center) | 16.625 in. |

DRIVE SHAFT - TRANSMISSION TO REAR DIFFERENTIAL

| | |
|---|---|
| Make | Rockwell Standard Corporation |
| Model | 82NLS40-10 |
| Length compressed (bearing center to bearing center) | 22.875 in. |
| Length extended (bearing center to bearing center) | 25.875 in. |

DRIVE SHAFT - TRANSMISSION TO TRANSFER DRIVE

| | |
|---|---|
| Make | Rockwell Standard Corporation |
| Model | 82NYSM40-49 |
| Length compressed (bearing center to bearing center) | 11.812 in. |
| Length extended (bearing center to bearing center) | 13.688 in. |

DRIVE SHAFT - TRANSFER DRIVE TO FRONT DIFFERENTIAL

| | |
|---|---|
| Make | Rockwell Standard Corporation |
| Model | 82NLS40-10 |
| Length compressed (bearing center to bearing center) | 29.750 in. |
| Length extended (bearing center to bearing center) | 32.750 in. |

TRANSFER DRIVE

| | |
|---|---|
| Make | Hough Division International Harvester Co. |

### LUBRICANTS AND CAPACITIES

| ITEM | TYPE LUBRICANT | | | | CAPACITY |
|---|---|---|---|---|---|
| | I. H. | API | SAE | MILITARY SPECIFICATION | |
| Drive Shafts | IH 251H EP | Multi-Purpose NLGI Grade 2 Lithium base | | MIL-G-10924B | AR |
| Transfer Drive | IH 135H EP | GL-5 | 90 | MIL-L-2105B | 1 pt. |

### TOLERANCES

| | |
|---|---|
| Transfer drive bearing end play | .002"-.004" |

## SERVICE INFORMATION

### SPECIAL TORQUES

| | |
|---|---|
| Drive shaft mounting cap screws: | |
| Torque converter to transmission | 40-50 ft. -lbs. |
| All others | 90-100 ft. -lbs. |
| Drive shaft lock nuts: | |
| 3/8" jam nut | 18-27 ft. -lbs. |
| 3/8" nylon lock nut | 12-18 ft. -lbs. |
| 1/2" nylon lock nut | 27-40 ft. -lbs. |
| Drive shaft spider and bearing mounting cap screws: | |
| Torque converter to transmission | 40-50 ft. -lbs. |
| All others | 90-100 ft. -lbs. |
| Parking brake backing plate mounting cap screws | 36 ft. -lbs. |
| Transfer drive cover cap screws | 33-37 ft. -lbs. |
| Transfer drive mounting cap screws | 80-90 ft. -lbs. |
| Transfer drive yoke lock nuts | 200 ft. -lbs. |

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## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
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# SECTION VI
# SOLID AXLES

SECTION VI SOLID AXLES


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## GENERAL INFORMATION

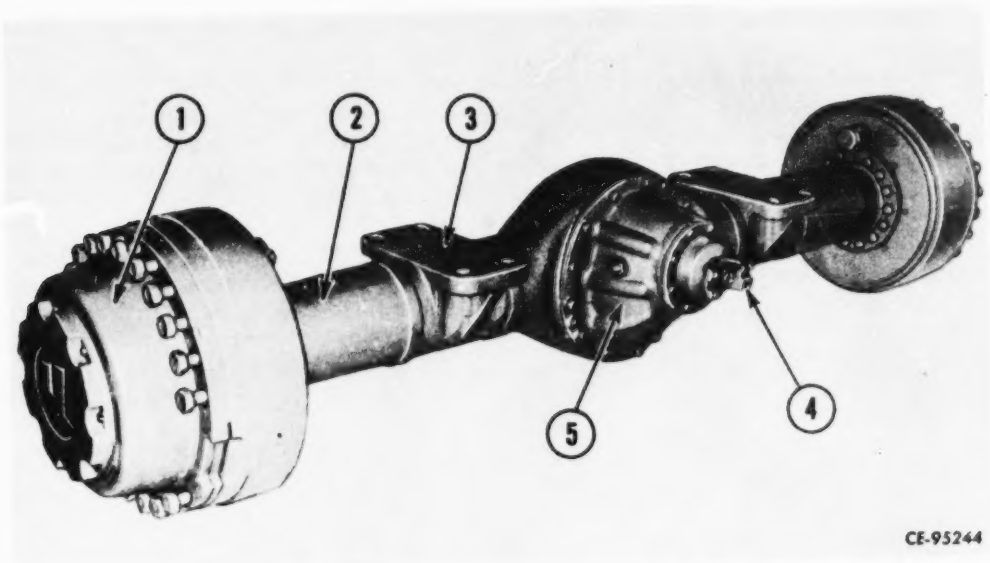


Figure 6-1
Typical Solid Axle.

1. Planetary carrier.
2. Axle housing.
3. Mounting pad.
4. Input yoke.
5. Differential assembly.

## DESCRIPTION

The axle assemblies accomplish three main functions; transmit the out-going twisting force (torque) at 90° to the left and right of its input direction, increase the input torque through reduction gearing, and provide a means of securing the wheels and at the same time support the tractor. To each of these main functions several secondary requirements are added suggesting a complex piece of machinery. In reality, each axle uses a minimum of parts to carry out its many functions. Simplicity of design increases reliability and provides easy servicing.

Both axles are full floating, double reduction type. The axles are rigidly attached to their supporting members; the front main frame in the case of the front axle and an oscillating cradle called a bolster for the rear. By allowing the rear axle to oscillate, the tractor is assured great stability in rough terrain.

The first gear reduction takes place in the differential; the second in the planetaries. Each wheel revolves on two tapered roller bearings mounted on the axle spindle. The axles are full floating in that none of the weight is supported by, or transmitted to, the axle shafts. All weight on the axle is supported by the wheels, bearings and axle housing.

The differential assemblies are rigidly mounted; one on the forward side of the rear axle housing and one on the rear side of the front axle housing. The differentials are connected by splined yokes to the yokes on the propeller shafts from the transmission.

The basic differential consists of a hypoid ring gear, pinion gear and spider gear assembly. The differential and spider gear assembly rotate on tapered roller bearings. The pinion is straddle mounted, having two tapered roller bearings in front of the pinion teeth to take the forward and reverse thrust and a straight roller bearing behind the pinion teeth to carry the radial load.

Three functions of the differential are: transmitting torque from the propeller shaft to the axle shafts; producing the first torque multiplication in the double reduction axles, and allowing one drive wheel to rotate a different speed than opposite wheel.

# SOLID AXLES

## GENERAL INFORMATION

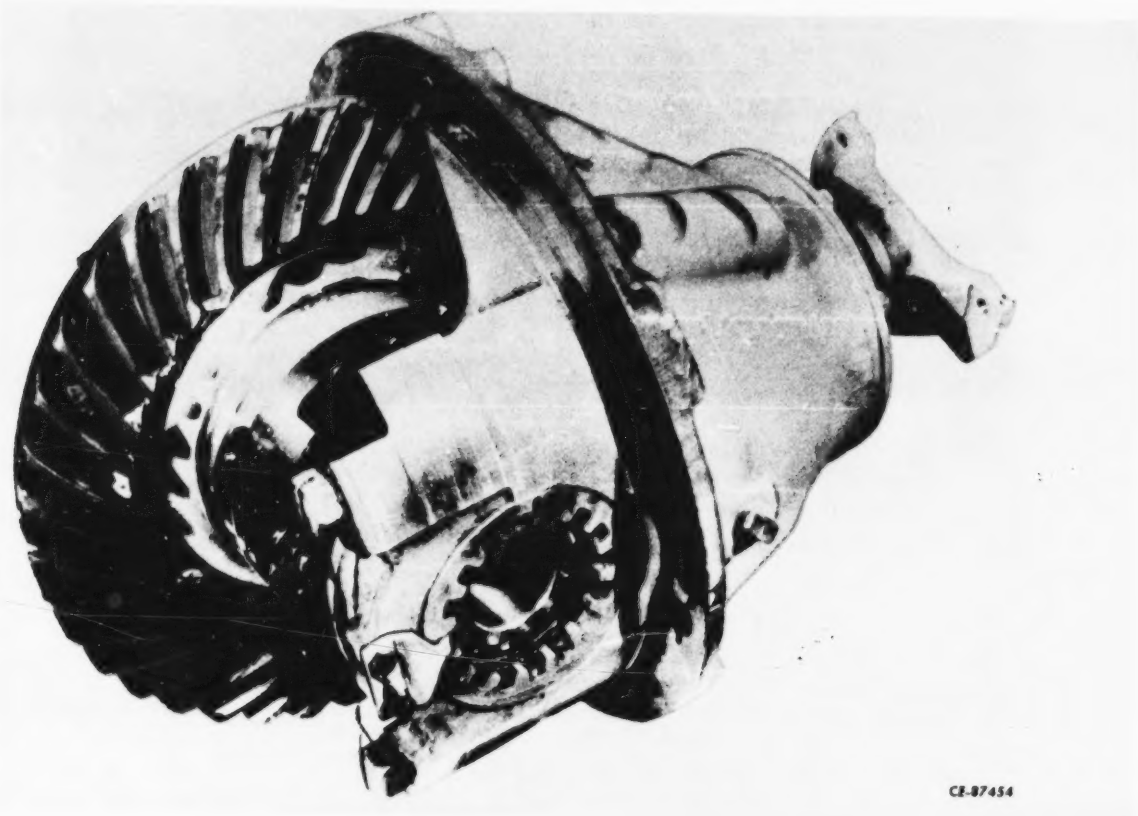


Figure 6-2
Typical Differential.

## PREVENTIVE MAINTENANCE

### LUBRICANT

Quantities and recommended lubricant are listed under "SERVICE INFORMATION" in this section.

### OIL CHANGE INTERVALS

Axle lubricant should be changed at regular intervals of 1000 hours. Drain while assembly is warm to allow contaminates to flow out with the draining lubricant. Refill the assembly with the specified lubricant. Check the lubricant level after each 100 hours of operation.

### LEVEL CHECK

Check the level of the lubricant in the differentials at the oil level plug (1, Fig. 6-3).

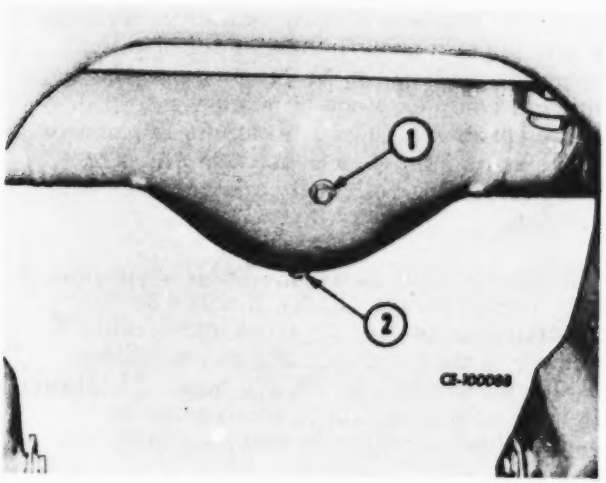


Figure 6-3
Differential Oil Level Plug and Drain Plug.

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## GENERAL INFORMATION

The lubricant should be even with the level of the plug hole.

NOTE: Be sure the machine is on level ground before checking the lubricant level.

Prior to checking the level of the lubricant in each planetary hub, rotate the wheel until the "Oil Level" mark on the planetary cover is horizontal and below the centerline of the wheel and hub assembly. The lubricant should be even with the level of the plug hole (1, Fig. 6-4).

### BRAKE ADJUSTMENT

Refer to Section XIII, "BRAKE SYSTEM" for correct adjustment procedure.

### DIFFERENTIAL ADJUSTMENT

The differential gears should be checked for backlash and correct tooth patterns after overhaul. If differential trouble is suspected, check these adjustments before overhaul to determine whether adjustment will correct the trouble. Refer to "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY" for correct adjustment procedure.

## AXLE DISASSEMBLY AND ASSEMBLY

NOTE: Service instructions following are for a typical double reduction planetary axle. While details may vary, basic construction and principles remain the same.

### DISASSEMBLY PREPARATION

Axle disassembly preparation should include:

Installing safety bar with tractor in straight ahead position.

Removing wheels and tires.

Disconnecting drive shaft and brake lines at axle.

Removing axle from tractor.

Using plain steam (no caustic soda) to clean exterior of axle.

Preparing a clean work area of sufficient size.

Providing a suitable hoist and sling to lift component parts.

Support axle assembly with axle bowl drain plug facing down.

Drain planetary hubs by rotating them until drain filler plugs (1, Fig. 6-4) are at the bottom. Remove plugs and "O" rings and drain lubricant.

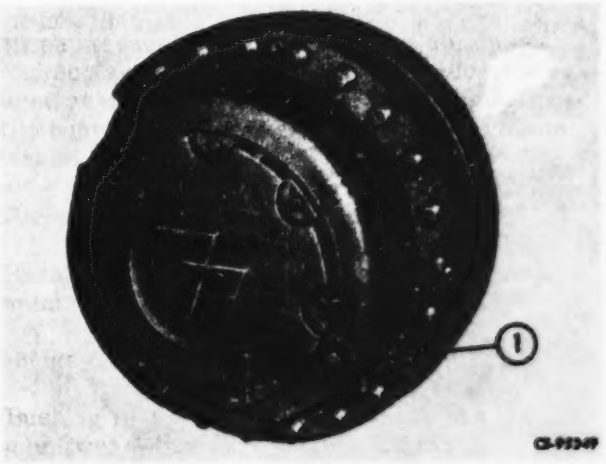


Figure 6-4

## AXLE DISASSEMBLY AND ASSEMBLY

### DISASSEMBLY

Remove cap screws (1, Fig. 6-5) and sealing washers (2) that secure planetary cover (4) to carrier assembly (3). Remove planetary cover and discard its gasket. Discard sealing washers.

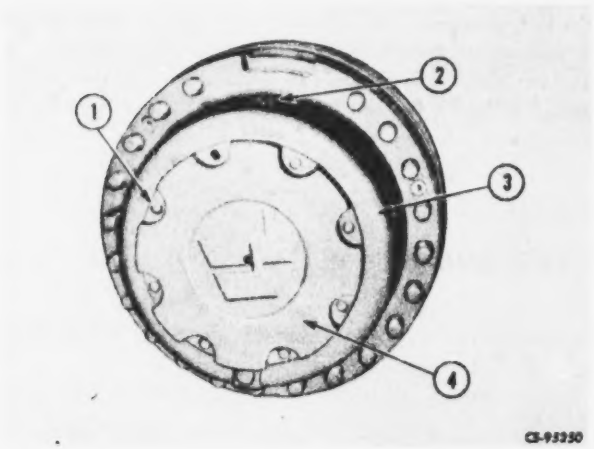


Figure 6-5

Thread axle removal tool (1, Fig. 6-6) (refer to "SPECIAL TOOLS" under "SERVICE INFORMATION") in tapped pilot hole in axle shaft. Remove shaft from housing.

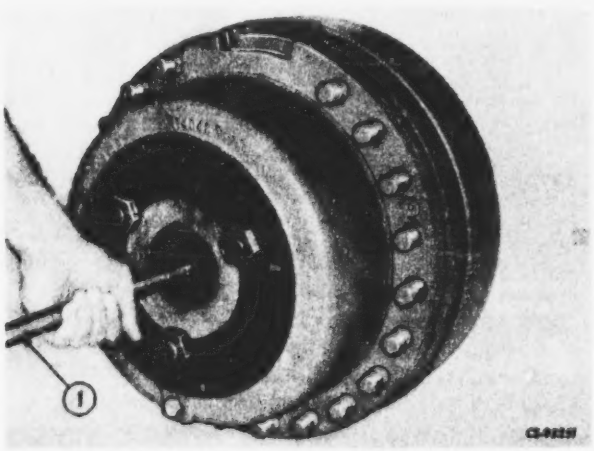


Figure 6-6

Using a socket head screw key remove flat head cap screws (2, Fig. 6-7) that secure planetary carrier (3) to wheel hub (1).

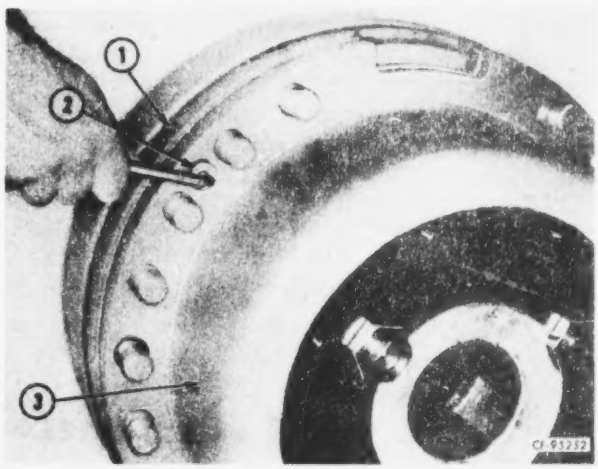


Figure 6-7

Using hoist with a suitable sling, remove planetary carrier assembly (1, Fig. 6-8).

For carrier assembly overhaul, refer to "PLANETARY DISASSEMBLY AND ASSEMBLY."

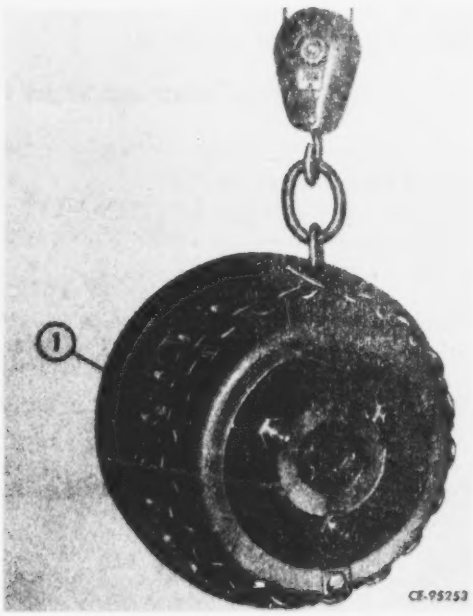


Figure 6-8

## AXLE DISASSEMBLY AND ASSEMBLY

Remove seal ring (1, Fig. 6-9) from wheel hub shoulder. Remove retainer cap screws, retainer (3) and shim pack (2). Tie shim pack together and tag to indicate which side of axle assembly they were removed from. Clean all sealant from retainer cap screws.

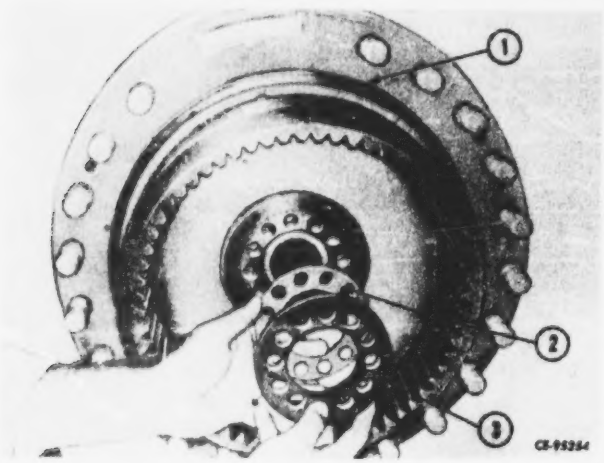


Figure 6-9

Using a hoist and sling remove ring gear and hub assembly (2, Fig. 6-10) from axle housing splines.

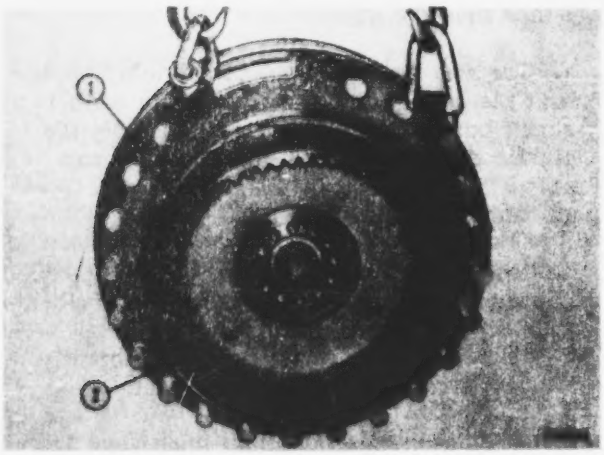


Figure 6-10

In some cases it may be necessary to pry ring gear and hub assembly from axle splines. Use a pair of suitable pry bars, placed opposite each other, between wheel hub (1) and ring gear assembly (2).

NOTE: Do not damage bearing cage, bearing race, or seal surfaces with pry bars.

For ring gear and hub overhaul refer to "PLANETARY DISASSEMBLY AND ASSEMBLY."

Attach hub and drum lifting tool (1, Fig. 6-11) (refer to "SPECIAL TOOLS" under "SERVICE INFORMATION") to one of the wheel studs. Lift off wheel hub (3) and brake drum (2) as an assembly. Do not allow brake drum to pull free of hub and fall. (Under most circumstances these two items will be snug fitting.)

Refer to "WHEEL HUB DISASSEMBLY AND ASSEMBLY" for overhaul procedures.

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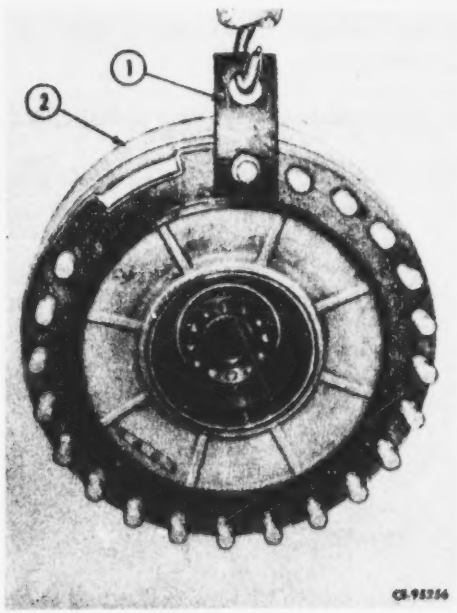


Figure 6-11

## AXLE DISASSEMBLY AND ASSEMBLY

### DISASSEMBLY - Continued

Remove cap screws (1, Fig. 6-12) and hex nuts that secure brake spider to axle housing. Remove brake assembly.

Refer to Section XIII, "BRAKE SYSTEM" for brake overhaul procedures.

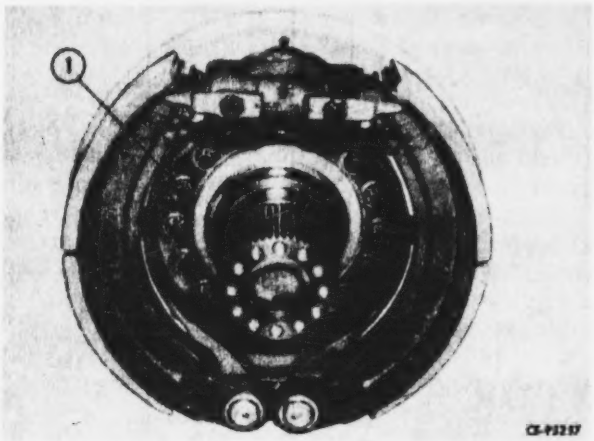


Figure 6-12

Remove and discard axle seal (2, Fig. 6-13) from housing bore.

Remove seal retainer (1) from housing hub.

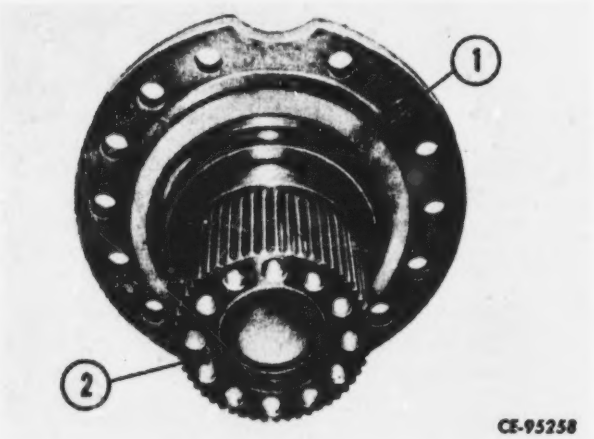


Figure 6-13

Remove and discard "O" ring (1, Fig. 6-14) from seal retainer. Check polished surfaces and ring groove of retainer for nicks, dents or burrs. Replace retainer if damage is beyond repair.

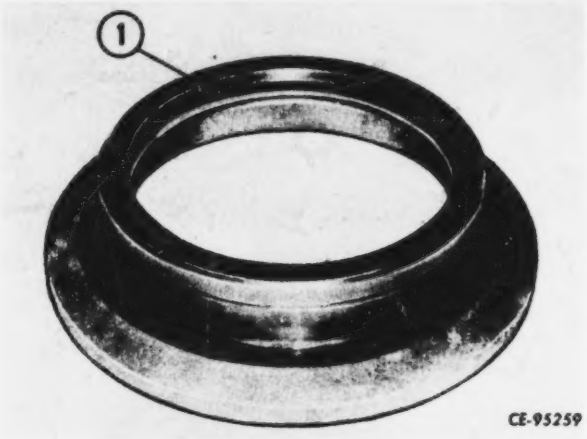


Figure 6-14

Remove drain plug (2, Fig. 6-3) from axle bowl and drain lubricant. When housing is completely drained rotate housing until differential yoke is in a vertical position.

To remove the differential assembly the following steps must be taken:

a. One at a time, using an acetylene torch, heat the axle housing in the area of each screw bore. Sufficient heat will liquify the plastic gasket material and allow the cap screw to be removed with a reasonable amount of effort.

As each screw bore is heated, apply approximately 200 lbs. of torque in a counterclockwise direction to the cap screw (1, Fig. 6-15). When the bore is heated sufficiently the cap screw will begin to turn out.

b. Place a chain sling about input yoke and using a suitable hoist, exert an upward pressure on differential assembly.

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## AXLE DISASSEMBLY AND ASSEMBLY

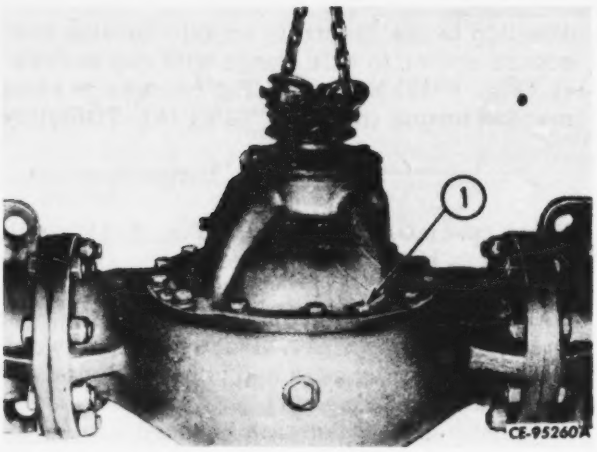


Figure 6-15

Again, using the acetylene torch, heat the entire flange of the differential carrier to liquify the plastic sealant and free the differential assembly.

NOTE: Both axle shafts must be removed before differential assembly can be pulled from housing.

In some cases it may be necessary to pry the heated units apart.

Refer to "DIFFERENTIAL DISASSEMBLY AND ASSEMBLY" for procedures.

## CLEANING AND INSPECTION

### CLEANING

Clean all parts thoroughly. Rough parts such as casting or all metal parts without finished, ground or polished surfaces may be cleaned in a hot solution of mild alkali. Parts should remain in the tank until thoroughly clean and heated through.

◆ WARNING: EXERCISE CARE TO AVOID SKIN RASHES, FIRE HAZARDS AND INHALATION OF VAPORS WHEN USING SOLVENT TYPE CLEANERS.

Clean other parts with a solvent type cleaner such as petroleum solvents, excluding gasoline.

Flush out axle housing being sure it is completely clean. Be sure all flaked metal deposits and dirt are removed from the corners. Cover the differential opening with a plastic cover when housing is clean and dry.

Dry parts thoroughly with soft, clean absorbent paper towel or abrasive free cloth.

CAUTION: NEVER dry bearings by spinning with compressed air.

### INSPECTION

Inspect all bearings, cups and cones, including those not removed from the axle. Replace any parts that are worn, pitted or damaged in any way. Remove parts needing replacement with a puller or press, using suitable arbors. Avoid the use of drifts or hammers.

Inspect all gears and splines for wear or damage. Replace all parts that are scored, pitted, ridged or worn.

Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

Coat parts that are to be assembled immediately with light oil to prevent corrosion. If parts are to be stored for any length of time or if they are not to be assembled immediately, coat them with a good grade of rust preventive and wrap in paper, treated to prevent corrosion.

Replace all seals, gaskets, "O" rings and retaining rings.

Assemble the following tools and supplies.

Torque wrench - 500 ft. lb. capacity.
Torque multiplier - 4-to-1.
Loctite Plastic Gasket, or equivalent.
Axle shaft tool - Refer to "SPECIAL TOOLS."

# SOLID AXLES

## AXLE DISASSEMBLY AND ASSEMBLY

### ASSEMBLY

Be sure mating surfaces of differential carrier and axle housing are absolutely clean and free of nicks or burrs.

Coat differential mounting face of axle housing with "LOCTITE PLASTIC GASKET." Apply a light coating of plastic gasket to threads of retaining cap screws (1, Fig. 6-15). With axle housing blocked securely lift differential into position on axle housing, being sure holes are correctly aligned.

NOTE: Follow manufacturers instructions for application and curing time for "LOCTITE PLASTIC GASKET."

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

Install cap screws (1) and lock washers, tightening gradually and evenly around circumference of carrier flange. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install a new "O" ring seal (1, Fig. 6-14) in groove of seal retainer (1, Fig. 6-13). Grease seal surface of axle hub and "O" ring. Push retainer (1) into position being sure it contacts axle housing flange about its entire circumference.

Inspect end surface of axle spindle for nicks, burrs or other irregularities. If necessary, file surface until it is flat and smooth. File carefully to prevent a wavy surface. Entire surface must be at 90° to centerline of axle bore.

Coat O. D. of a new axle seal (2) with "Mar-Seal" or equivalent sealant and using a suitable driver, install seal in axle bore. This seal must bottom in its bore.

Position brake assembly on axle housing and secure spider to axle flange with cap screws (1, Fig. 6-12) and nuts. Tighten nuts to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Using special lifting tool (1, Fig. 6-11) position wheel hub/brake drum assembly on axle spindle.

Start ring gear and hub assembly (2, Fig. 6-10) on axle spindle splines. Place a 4" x 4" wooden block across ring gear and using a sledge or heavy mallet, drive ring gear and hub assembly on spindle until it bottoms in wheel hub (1) bearing cup.

Position retainer (3, Fig. 6-9) against ring gear hub WITHOUT shims. Secure retainer with three equally spaced cap screws. Tighten the cap screws evenly to recommended preliminary torque (refer to "SPECIAL TORQUES") WHILE ROTATING THE WHEEL HUB.

Preliminary Torque:_____

Carefully measure the gap as shown in Fig. 6-16. Measure shims individually to obtain a shim pack thickness equal to the gap. To this shim pack add the recommended additional shims (refer to "TOLERANCES").

Additional Shim Pack:_____

The total shim pack should equal the measured gap plus the required additional shims or as close as possible to this dimension on the plus side.

Remove retainer and install entire shim pack. Install retainer and secure with all cap screws. Coat threads of each cap screw with "LOCTITE PLASTIC GASKET" before installation. Tighten cap screws to recommended final torque (refer to "SPECIAL TORQUES") WHILE ROTATING THE WHEEL HUB.

Final Torque:_____

Lubricate a new seal ring (1, Fig. 6-9) with grease and install on wheel hub shoulder. Be sure there are no twists in seal ring.

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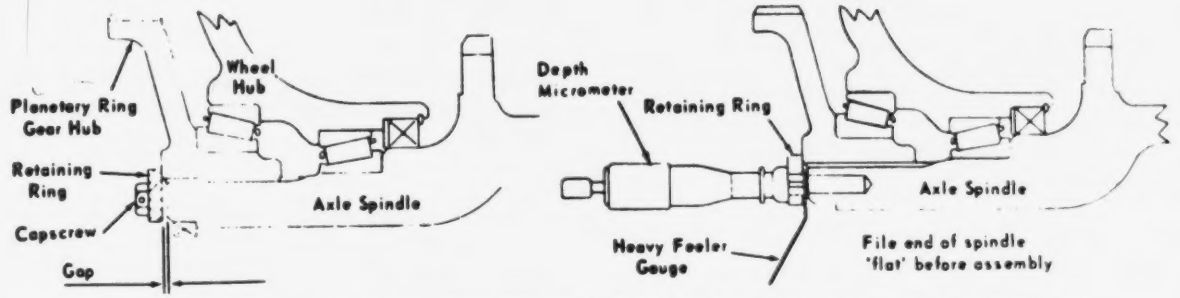
## AXLE DISASSEMBLY AND ASSEMBLY




Use a depth micrometer to measure thru a bolt hole in the retaining ring to a heavy feeler gauge held across a threaded bolt hole in the spindle. ADD the thickness of the feeler gauge to the micrometer reading and SUBTRACT the MEASURED thickness of the retaining ring to determine gap. (Average the measured result of readings taken at two different locations.)

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Figure 6-16
Shimming Procedure.

Using a suitable sling and hoist, position planetary carrier assembly (1, Fig. 6-8) on axle. As carrier is installed planet gear teeth must mesh with ring gear teeth; large cut-out in carrier must be in alignment with cut-out in wheel hub.

Be sure carrier assembly (3, Fig. 6-7) is flush against wheel hub (1). Install flat head cap screws (2) to secure the two assemblies and tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Using axle removal and installation tool (1, Fig. 6-6) (refer to "SPECIAL TOOLS") install axle in housing.

Using tool as a lever, raise inner end of axle shaft to engage differential side gear splines. As sun gear end of shaft enters planetary assembly align shaft gear teeth with planet gear teeth.

Carefully inspect thrust button (1, Fig. 6-17) in planetary cover for excessive wear. Replace unit if required.

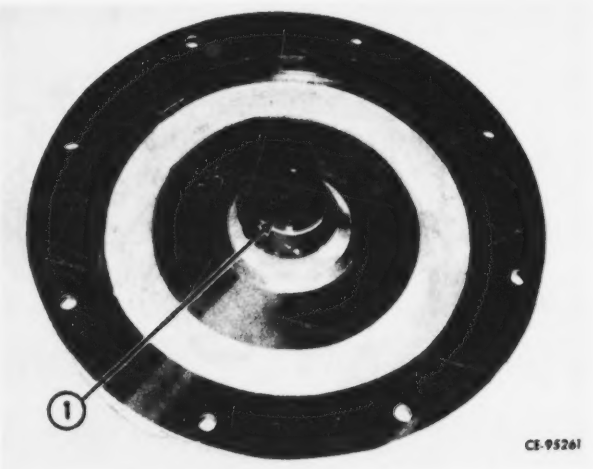


Figure 6-17

Position a new gasket on the planetary cover being careful to align the cap screw holes. Position cover and gasket assembly on planetary carrier; align cap screw holes and secure with cap screws and new sealing washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

(Continued on next page)

## AXLE DISASSEMBLY AND ASSEMBLY

### ASSEMBLY - Continued

Rotate planetary hub until "Oil Level" line is horizontal (Fig. 6-4). Remove drain and fill plug (1) and "O" ring. Discard "O" ring. Fill planetary hub to level of plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES"). Install plug with new "O" ring. Tighten plug securely.

Rotate axle until differential input is horizonatal. Install drain plug (2, Fig. 6-3).

Fill axle bowl to level of plug hole with recommended lubricant (refer to "LUBRICANTS AND CAPACITIES").

Install a new "O" ring on level plug and install plug assembly in housing. Tighten plug securely.

After mounting axle in tractor with wheels and tires installed, adjust each brake assembly (refer to Section XIII, "BRAKE SYSTEM").

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

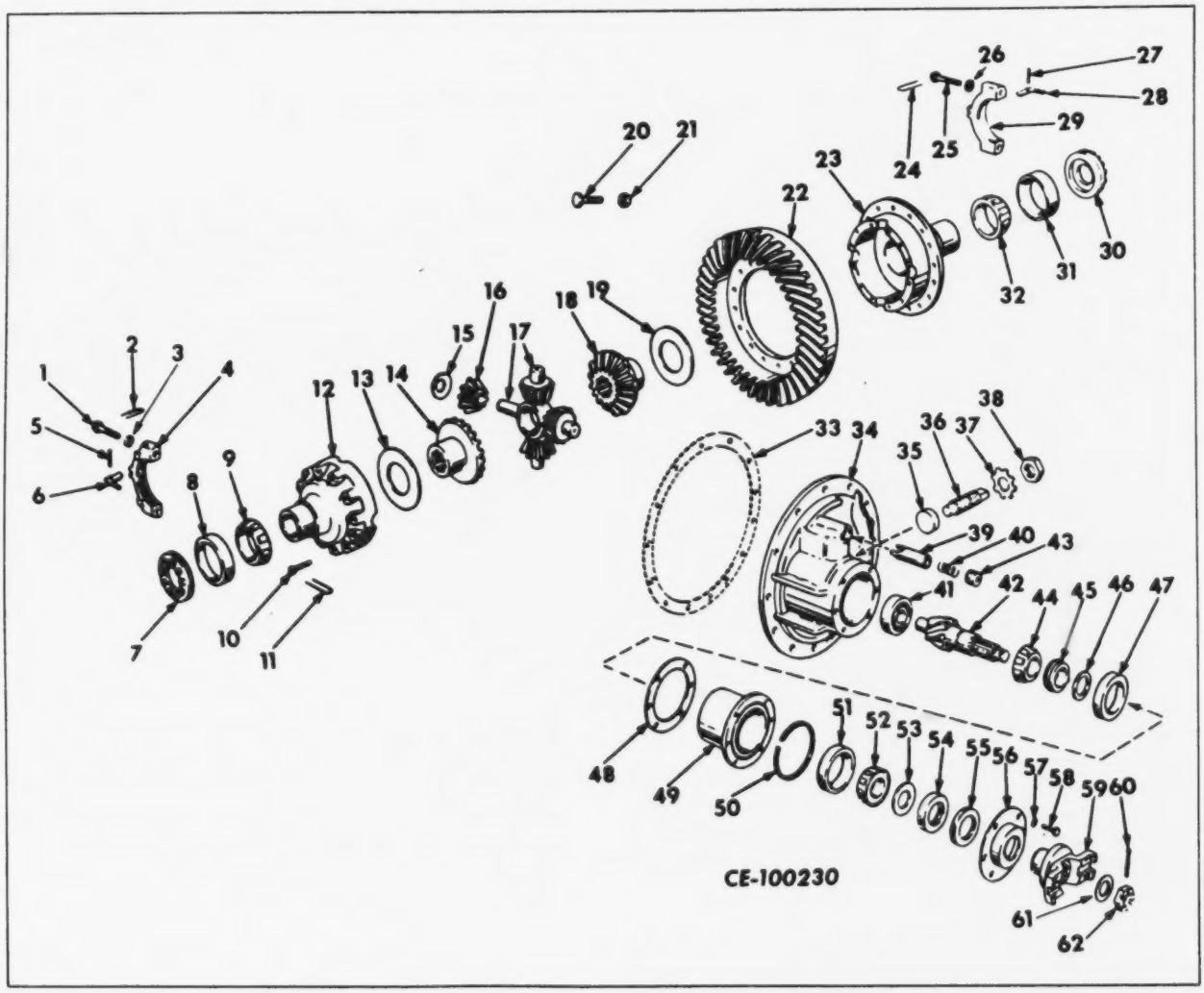


Figure 6-18
Differential - Exploded View.

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Legend for Figure 6-18

1. Cap screw.
2. Lockwire.
3. Nut.
4. Bearing cap.
5. Cotter pin.
6. Adjuster lock.
7. Adjuster nut.
8. Bearing cup.
9. Bearing cone.
10. Cap screw.
11. Lockwire.
12. Differential case.
13. Thrust washer.
14. Side gear.
15. Thrust washer.
16. Side pinion.
17. Spider.
18. Side gear.
19. Thrust washer.
20. Ring gear bolt.
21. Nut.
22. Ring gear.
23. Flanged case half.
24. Lock wire.
25. Cap screw.
26. Nut.
27. Cotter pin.
28. Adjuster lock.
29. Bearing cap.
30. Adjuster nut.
31. Bearing cup.
32. Bearing cone.
33. Gasket.
34. Carrier.
35. Thrust block.
36. Adjusting screw.
37. Lock.
38. Lock nut.
39. Oil distributor.
40. Spring.
41. Pinion pilot bearing.
42. Pinion.
43. Pipe plug.
44. Pinion bearing cone.
45. Pinion bearing spacer.
46. Spacer washer.
47. Pinion bearing cup.
48. Pinion bearing cage shim.
49. Pinion bearing cage.
50. Seal.
51. Pinion bearing cup.
52. Pinion bearing cone.
53. Flat washer.
54. Oil seal.
55. Oil seal.
56. Oil seal retainer.
57. Lock washer.
58. Cap screw.
59. Companion flange.
60. Cotter pin.
61. Flat washer.
62. Pinion nut.

### DISASSEMBLY PREPARATION

Remove the differential assembly from the axle (refer to "AXLE DISASSEMBLY AND ASSEMBLY"). Differential disassembly preparation should include:

a. Using plain steam (no caustic soda), clean the outside of the differential housing thoroughly.

b. Preparing a clean work area.

c. Gathering the following tools and equipment:

A differential holding fixture (refer to "SERVICE INFORMATION" under "SPECIAL TOOLS").
A shop press.
A hoist of sufficient capacity.

### DISASSEMBLY

Place differential assembly in a suitable holding fixture (refer to "SERVICE INFORMATION" under "SPECIAL TOOLS").

Remove oil distributor pipe plug (43, Fig. 6-18), spring (40) and oil distributor (39).

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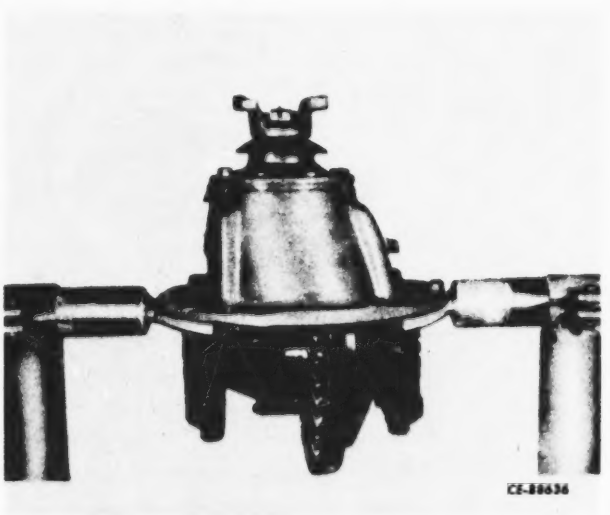


Figure 6-19

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

### DISASSEMBLY - Continued

Punch mark the bearing caps (3, Fig. 6-20) and carrier housing legs (4) to assure correct assembly.

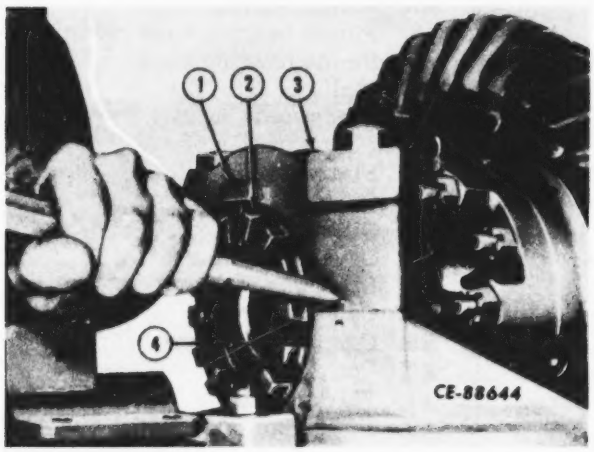


Figure 6-20

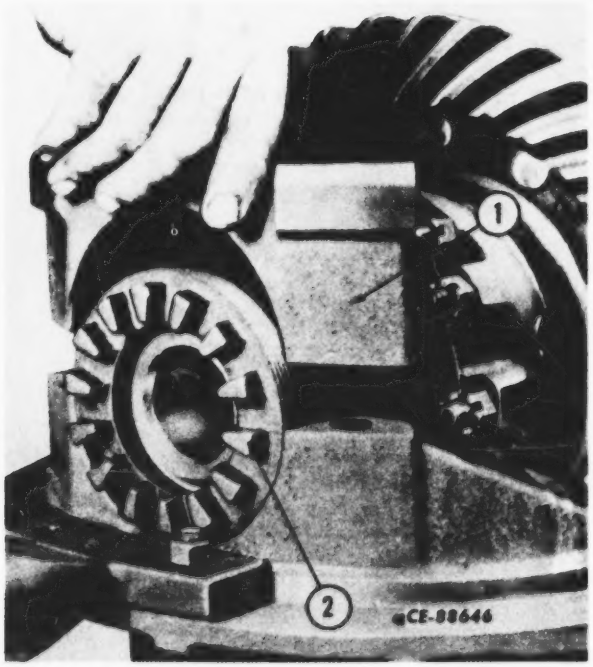


Figure 6-21

Remove cotter pins (1) that secure adjusting nut (2) locks and remove locks.

Remove lock wire and bearing cap bolts that secure bearing caps (1, Fig. 6-21) to carrier housing.

Tap bearing caps with a fiber hammer to loosen and remove them from carrier bearings. Remove bearing adjusting nuts (2).

Loosen jam nut (2, Fig. 6-22) and back off thrust adjusting screw (1).

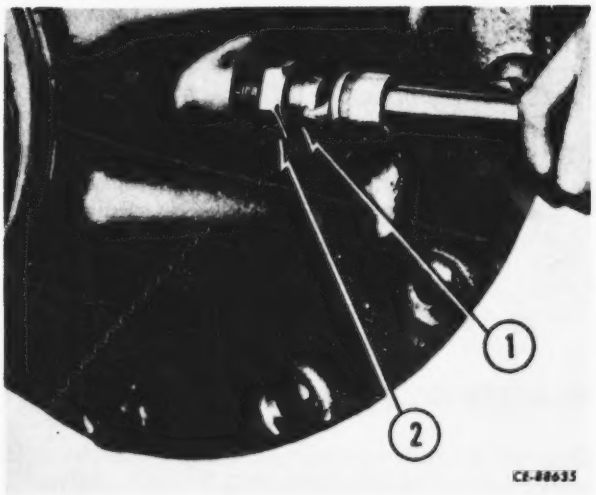


Figure 6-22

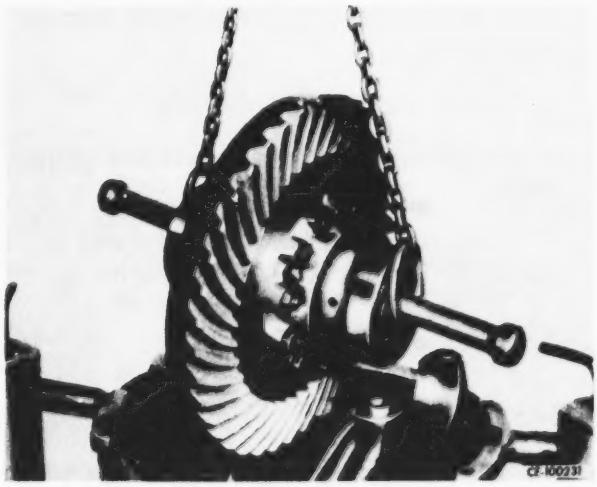


Figure 6-23

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Lift differential assembly just high enough to remove carrier bearing cups. Tag cups to identify them for correct assembly. As differential is lifted out of carrier housing (Fig. 6-23), tip it slightly to allow ring gear to clear pinion shaft bearing boss.

Remove thrust block (35, Fig. 6-18) from carrier housing.

If original identification marks are not clear, mark differential case halves with a punch or chisel to insure correct alignment during assembly (Fig. 6-24).

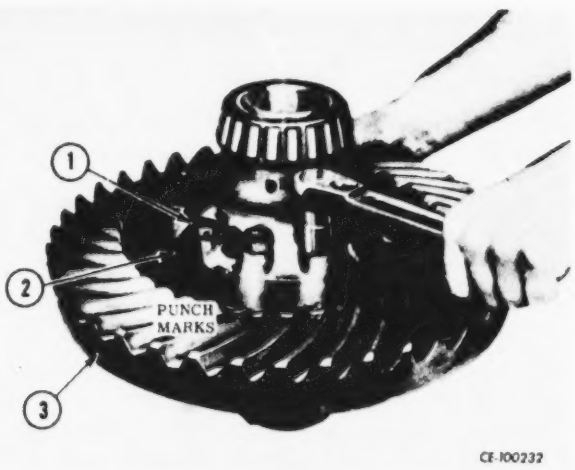


Figure 6-24

Cut lock wire; remove hex nuts and cap screws (1) that secure case halves (2, 3) and lift plain half (2) from flanged half (3). If a side gear comes off with plain case half be sure it does not fall.

Remove spider (1, Fig. 6-25) with spider gears (2) and thrust washers (3). The spider may be installed four ways and need not be marked before removal. Remove remaining side gear (4) and thrust washer (5).

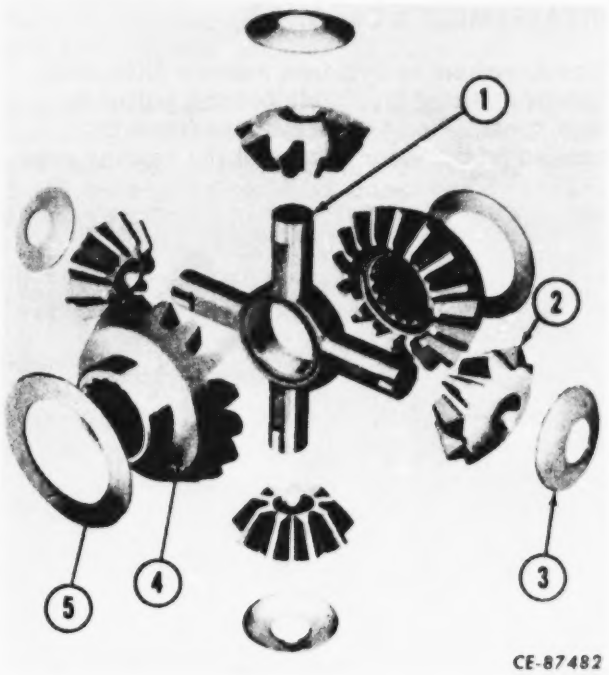


Figure 6-25

If removal of ring gear is required, remove hex nuts (1, Fig. 6-26), lock washers (2) and cap screws and separate ring gear (3) from case (4).

(Continued on next page)

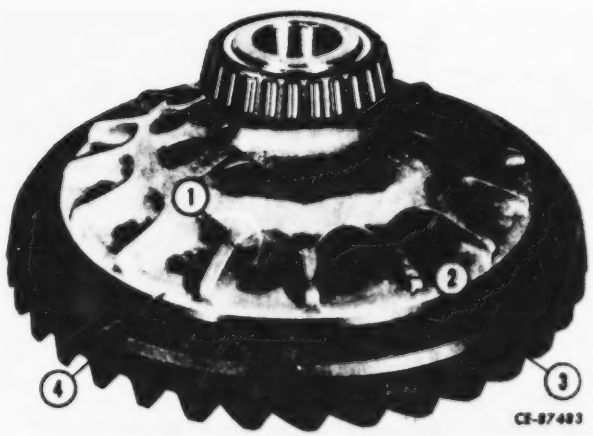


Figure 6-26

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

### DISASSEMBLY - Continued

If replacement is required remove differential bearings, using a suitable bearing puller or a shop press (Fig. 6-27). Be sure force is exerted on the inner race, not the bearing cage.

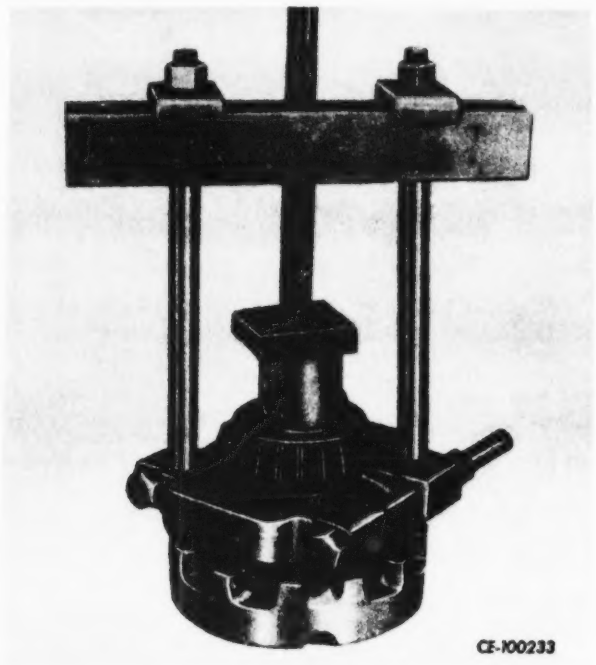


Figure 6-27

Rotate differential carrier in repair stand so that companion flange assembly (59, Fig. 6-18) is upward. Remove pinion bearing cap screws (58) and lock washers (57) that hold pinion bearing cage assembly (49) to carrier, as shown in Fig. 6-28.

Rotate carrier in repair stand so that companion flange is downward. Press or drive out assembled pinion taking care to apply pressure against outer race of bearing (41, Fig. 6-18).

NOTE: Do not drop assembly on companion flange.

Remove bearing cage shims (48) from assembled pinion. Measure thickness of shim pack and record it for use during reassembly or wire shim pack together and attach it to carrier for reference.

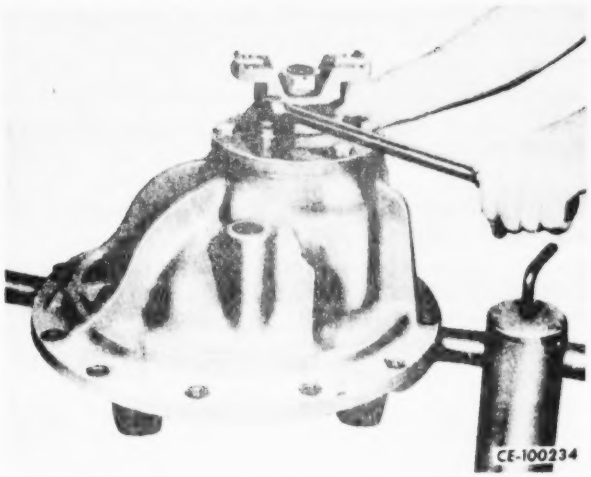


Figure 6-28

Hold companion flange assembly in a vise as shown in Fig. 6-29. Remove cotter pin (60, Fig. 6-18), pinion nut (62) and flat washer (61). Drive pinion assembly from companion flange assembly; remove assembled oil seal retainer (56), pinion bearing cage assembly (49) and bearing cup (51) and cone (52).

NOTE: If pinion bearing assembly is to be reused it will be necessary to retain the same relationship between cups and cones because of established wear pattern. Proper parts identification should be made during disassembly.

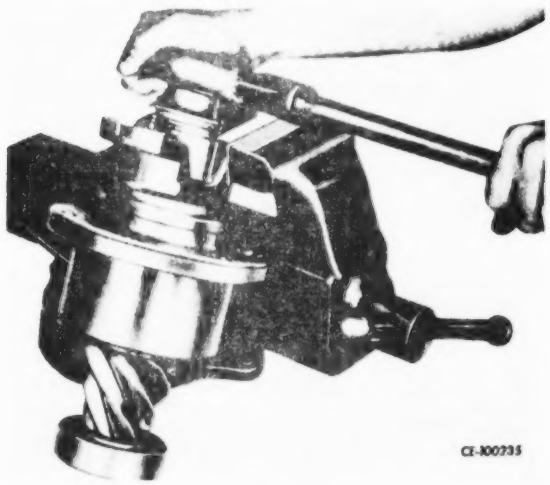


Figure 6-29

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Figure 6-30

Remove felt seal (55, Fig. 6-18) and oil seal (54) from oil seal retainer (56).

Remove flat washer (53, Fig. 6-18) and bearing cone (52) from pinion bearing cage assembly as shown in Fig. 6-30. Bearing cups (51, 47, Fig. 6-18) need not be removed unless cup or cone are damaged.

Remove and discard cork seal (50, Fig. 6-18) from pinion bearing cage (49).

Remove pinion bearing spacer washer (46, Fig. 6-18) and pinion bearing spacer (45) from pinion as shown in Fig. 6-31. Note thickness of spacer washer as a reference for reassembly.

Install a split type bearing puller over bearing (41, Fig. 6-18) as shown in Fig. 6-32. Press pinion from bearing cone (44, Fig. 6-18). Remove bearing (45) with puller.

Figure 6-31

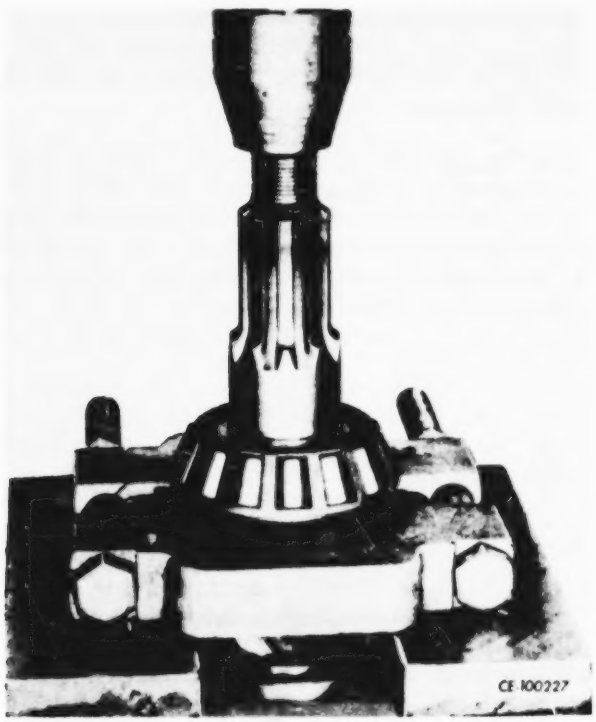


Figure 6-32

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

### CLEAN, INSPECT AND REPAIR

#### CLEANING

Parts having ground and polished surfaces such as gears, bearings, shafts and collars, should be cleaned in a suitable solvent like kerosene or diesel fuel oil.

NOTE: DO NOT USE GASOLINE
DO NOT USE A HOT SOLUTION TANK
DO NOT USE WATER AND ALKALINE SOLUTIONS
(Sodium hydroxide, orthosilicates or phosphates)

Steam cleaning assembled drive units after their removal from the axle housing is not recommended. Water trapped in these assemblies promotes corrosion of critical parts. This rust can be deposited in the lubricant causing premature failures.

Complete disassembly is necessary for thorough cleaning.

Rough parts such as differential castings may be cleaned in a hot solution of mild alkali providing these parts are not ground and polished. Parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid evaporation of rinse water. Parts should be thoroughly rinsed to remove all traces of alkali.

◆ WARNING: EXERCISE CARE TO AVOID SKIN RASHES AND INHALATION OF VAPORS WHEN USING ALKALI CLEANERS.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless, absorbent paper towels or rags, free of abrasive material. Bearings should never be dried by spinning with compressed air.

Parts that have been cleaned, dried and inspected and are to be assembled immediately should be coated with light oil to prevent corrosion. If parts are to be stored for any length of time, they should be treated with a good rust preventive and wrapped in special paper or other material designed to prevent corrosion.

#### INSPECTION

Careful inspection procedures will determine the success of the overhaul operation. A careful selection of reusable parts will eliminate the expense of down time in the near future.

Inspect all bearing cups and cones, including those not removed from parts of the drive unit. Replace these items if cups or rollers are worn, pitted or damaged in any way. Remove parts to be replaced with a suitable puller or press. Do not use drifts or hammers. They may easily damage or distort component parts.

Inspect hypoid gears for wear or damage. Worn, ridged, pitted or scored gears should be replaced. When it becomes necessary to replace either the ring or pinion gear, both gears must be replaced with a matched set.

Inspect differential case halves, thrust washers, spider trunnions and differential gears for pitted, scored or worn thrust surfaces. Thrust washers must be replaced in sets.

Inspect differential pinion gears and side gear teeth for wear or damage. Pinion and side gears must be replaced in sets.

#### REPAIR

Replace all worn parts including hex nuts with rounded corners.

Replace all seals, gaskets and lock washers.

Remove nicks, mars and/or burrs from machined or ground surfaces using a mill file or India stone. All threads must be clean and free to obtain accurate adjustment and correct torque.

Where possible, use a press when assembling component parts.

Tighten all nuts to specified torque. Use a soft iron locking wire to eliminate wire breakage.

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## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

The burrs caused by lock washers at the spot surface of stud holes of cages and covers, should be removed to assure easy assembly.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

### ASSEMBLY

If new bearing cups (1, Fig. 6-33) are to be installed, press cups firmly against pinion bearing cage (2) shoulders.

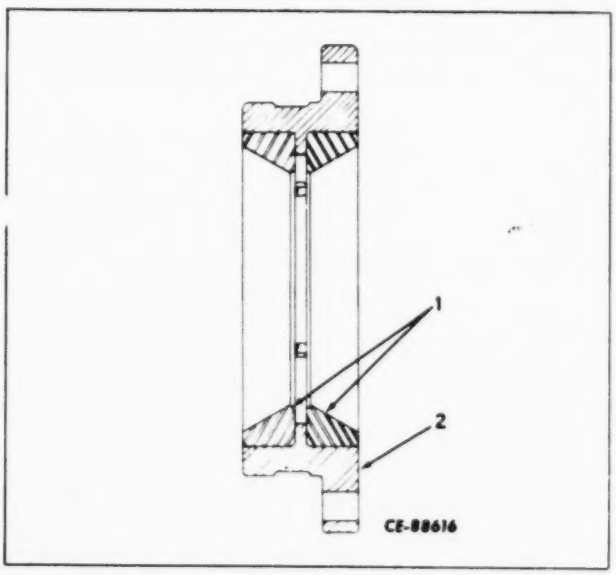


Figure 6-33

Lubricate bearing cups and cones with light machine oil.

Press bearing cone (44, Fig. 6-18) on pinion (42) against gear shoulder. Be sure bearing cone bottoms on gear shoulder.

Press pilot bearing (41) on stub end of pinion; stake pilot bearing to pinion in at least four places as shown in Fig. 6-34.

Figure 6-34

Install pinion bearing spacer (45, Fig. 6-18) and pinion bearing spacer washer (46) on pinion. Use a washer of same thickness as was noted in disassembly.

Lubricate bearings and install bearing cone (52) and flat washer (53) in bearing cage assembly (49).

Install assembled bearing cage assembly and companion flange assembly (59) on pinion. Tap flange lightly until it exposes pinion threads. Install pinion washer (61) and nut (62). Use it to draw down companion flange assembly, and tighten to recommended torque (refer to "SPECIAL TORQUES").

Pinion Nut Torque:_____

(Continued on next page)

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

### ASSEMBLY - Continued

Wrap a soft iron wire around outer circumference of bearing cage assembly. Pull on a line tangent to outside diameter of cage with a pound scale hooked to the wire. With flange held stationary, rotate cage with the pull of the spring scale.

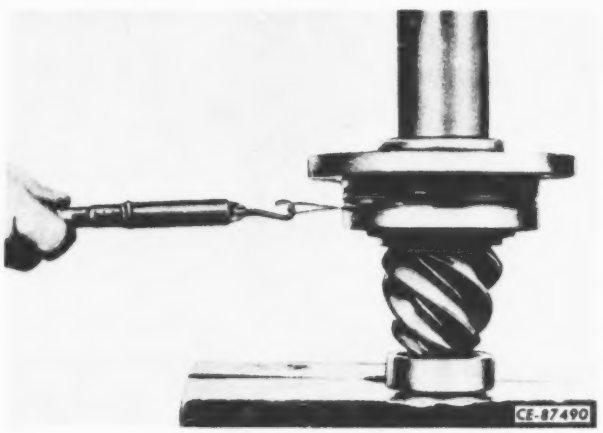


Figure 6-35

Read torque required to keep cage moving (the starting torque will be higher).

NOTE: Use rotating torque, not starting torque.

If torque is not within recommended limitations (refer to "TOLERANCES" under "SERVICE INFORMATION"), install a thinner spacer to increase or thicker spacer to decrease preload.

Preload Torque Limits:_____

Remove pinion nut and companion flange assembly. Install cork seal (50, Fig. 6-18) in groove of bearing cage with split at top side of head assembly.

Coat oil seal (54), felt seal (55) and retainer (56) with Lubriplate. Install oil seal and felt seal in the oil seal retainer. Be sure lip of seal is toward pinion cage.

Position assembled oil seal retainer on pinion; install companion flange assembly, washer and pinion nut as before. Tighten nut to recommended torque (refer to "SPECIAL TORQUES").

Pinion Nut Torque: _____

Install cotter pin.

NOTE: Do not back off nut to align cotter pin holes.

Install shim pack (2, Fig. 6-36), removed during disassembly, between bearing cage (1) and carrier (3).

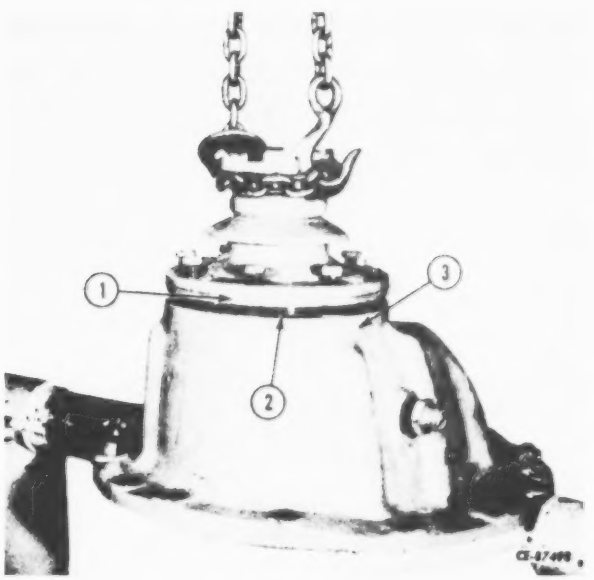


Figure 6-36

NOTE: Locate thin shims on outside of pack for best sealing ability.

Tap pinion and cage assembly in position with a soft mallet.

Install cage/cover retaining cap screws and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

Thread adjusting screw lock (37, Fig. 6-18) on adjusting screw (36).

Install adjusting screw in carrier far enough so thrust block (35) can be installed. Lubricate thrust block with Lubriplate and install it on the end of the screw.

Install ring gear (3, Fig. 6-26) on flanged case half (4) using retaining cap screws, flat washers (2) and hex nuts (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Lock wire the cap screws.

Position thrust washer (3, Fig. 6-37) and side gear (2) in ring gear and case half assembly (1) after lubricating parts with new axle lubricant (refer to "LUBRICANTS AND CAPACITIES").

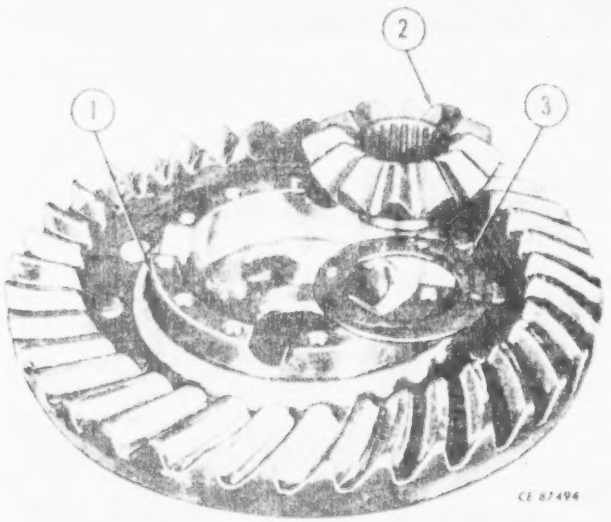


Figure 6-37

If ring gear thrust bearings (9, 32, Fig. 6-18) were removed, press new bearings squarely on case halves being sure they bottom on case shoulders. Use a suitable sleeve and press only on bearing inner race.

Lubricate spider (6, Fig. 6-38), pinion gears (2) and thrust washers (5) with new axle lubricant.

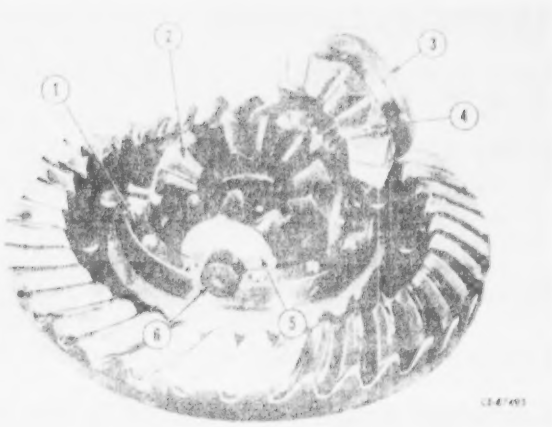


Figure 6-38

Place spider, pinion gears and thrust washers in position in case half (1).

Install remaining side gear (4) and thrust washer (3) after lubricating with new axle lubricant.

Align mating marks (1, Fig. 6-39) on case halves and secure assembly with four equally spaced cap screws and hex nuts.

(Continued on next page)

Figure 6-39

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

### ASSEMBLY - Continued

Check assembly for free rotation of differential gears. Correct if necessary.

Install remaining cap screws and hex nuts. Tighten all differential case cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Lock wire case retaining cap screws.

Lubricate bearings with new axle lubricant.

Place bearing cups over differential bearing cones and position differential assembly in carrier (Fig. 6-40).

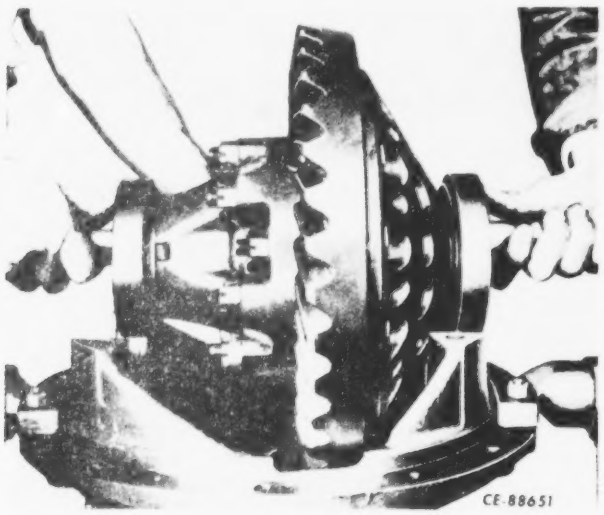


Figure 6-40

Install bearing adjusting nuts (2, Fig. 6-41). Hand turn them against bearing cups.

Install bearing caps (1) on their respective sides (refer to identification marks, Fig. 6-20) and tap lightly into position.

If caps do not position properly, adjusting nuts may be cross threaded. Remove caps and reposition adjusting nuts.

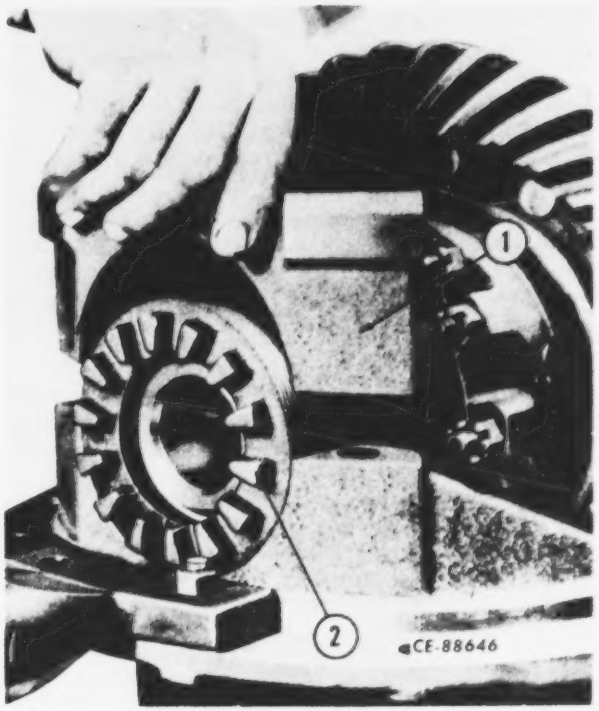


Figure 6-41

NOTE: Do not force caps into position.

Install bearing cap cap screws and torque to 25 ft. lbs.

Loosen bearing adjuster (7, Fig. 6-18) on tooth side of ring gear and tighten opposite adjuster (30) until all backlash is removed between pinion and ring gear. Measure backlash between gears with a dial indicator as shown in Fig. 6-42.

Tighten differential cap cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Backlash is adjusted by backing off one adjuster and tightening opposite adjuster the same amount. When backlash adjustment is within allowable limits, add a light preload by tightening adjuster on tooth side of ring gear an additional 1-1/2 to 2 notches. Refer to

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

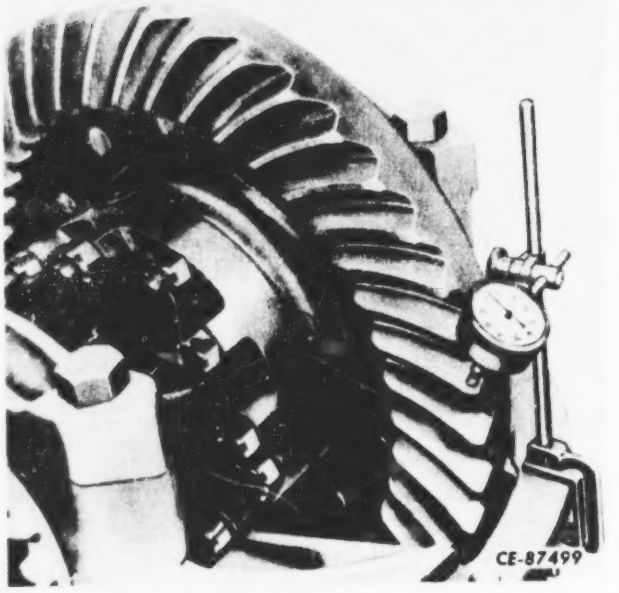


Figure 6-42

"TOLERANCES" for backlash limit recommendations.

Backlash Limits: _____

Apply oiled red lead (Fig. 6-43) to ring gear teeth. When pinion is rotated red lead is squeezed away by contact of teeth leaving an imprint the exact size, shape and location as the contact.

Figure 6-43

Sharper impressions may be obtained by applying a small amount of resistance to ring gear with a steel bar and using a wrench to rotate pinion. When making adjustments, check drive side of ring gear teeth. Coating approximately 12 teeth is sufficient to check tooth contact.

With adjustments properly made, contacts shown in Fig. 6-44 will be obtained. The area of contact favors the toe and is centered between top and bottom of tooth.

Figure 6-44

After a satisfactory tooth contact is obtained, especially in relation to top and bottom of the tooth, backlash may be altered within recommended limits (refer to "TOLERANCES") to obtain a better contact position relative to length of tooth.

Backlash Alteration Limits: _____

A high backlash setting can be used to keep contact from starting too close to the toe. A low backlash setting can be used to keep contact from starting too far away from the toe.

(Continued on next page)

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

### ASSEMBLY - Continued

The hand rolled pattern shown in Fig. 6-45 will result in a pattern centered in the length of the tooth when the gears are under load. The loaded pattern will be almost full length and the top of the pattern will approach the top of the gear tooth.

Figure 6-45

The pattern on the coast side of the teeth will appear the same width as the drive side; however the over-all length will be centered between the toe and heel of the gear tooth.

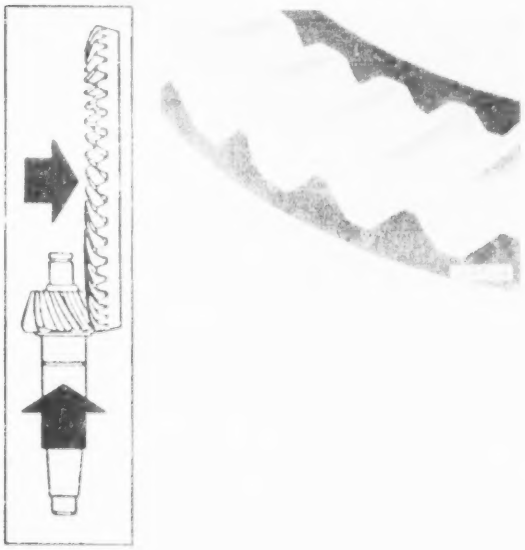

Figure 6-46

Set used gears with tooth contacts to match the established wear pattern. Hand rolled patterns of used gears will be smaller in area and should be at the toe end of the wear pattern.

A high contact (Fig. 6-46) indicates the pinion is too far out. Set the pinion to the correct depth by removing shims under the pinion cage. A slight outward movement of the ring gear may be necessary to maintain correct backlash.

A low contact (Fig. 6-47) indicates the pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the ring gear may be necessary to maintain correct backlash.

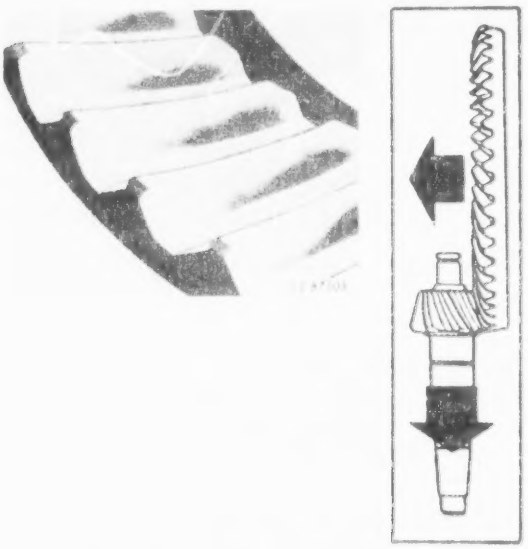

Figure 6-47

Recheck the screw-to-ring gear clearance for a full rotation of the ring gear.

After establishing correct tooth contact, install adjusting nut locks (2, Fig. 6-48). Lock wire bearing cap retaining cap screw (1).

Remove carrier from holding fixture. Position assembly with back face of ring gear upward.

Hold jam nut (38, Fig. 6-18) and turn adjusting screw (36) in until thrust block (35) is pressed firmly against back face of ring gear (22).

## DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

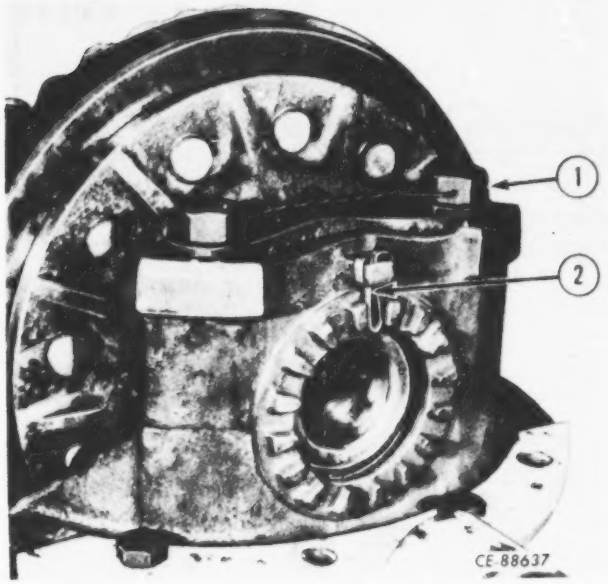


Figure 6-48

Back off adjusting screw until recommended clearance (refer to "TOLERANCES" under "SERVICE INFORMATION") is obtained.

Thrust Block Clearance:_____

Hold adjusting screw and tighten jam nut securely as shown in Fig. 6-49.

Recheck thrust block-to-ring gear clearance for a full rotation of ring gear.

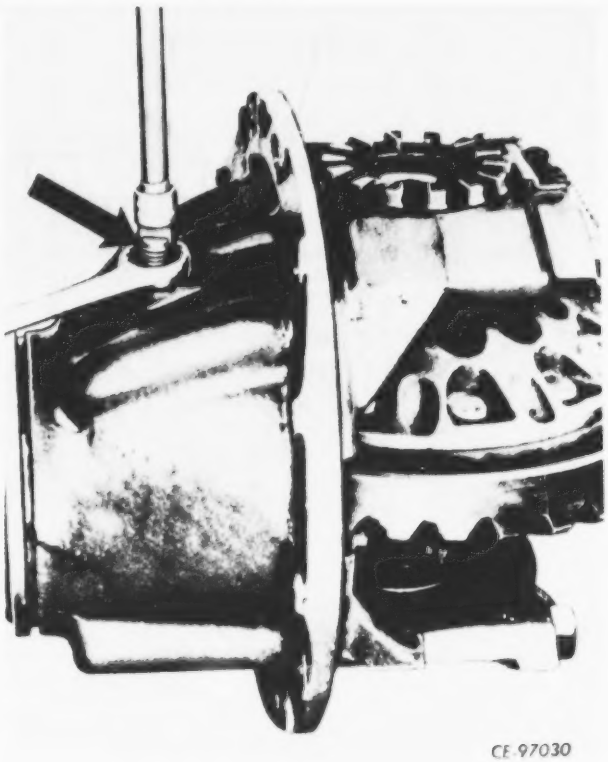


Figure 6-49

Install oil distributor (39, Fig. 6-18), spring (40), and pipe plug (43).

Refer to "AXLE DISASSEMBLY AND ASSEMBLY" for installation procedure.

## PLANETARY DISASSEMBLY AND ASSEMBLY

### DISASSEMBLY PREPARATION

Disassembly preparation should include:

a. Removing planetary assemblies from axle (refer to "AXLE DISASSEMBLY AND ASSEMBLY").

b. Preparing a clean work area of sufficient size.

c. Cleaning outside of planetary carrier assembly with solvent (no caustic soda).

d. Secure the following equipment:

Work bench
Suitable hoist
Hydraulic press

A quantity of dry ice, sufficient to chill ring gear hubs, will be required if hub bearing cones are removed.

# SOLID AXLES

## PLANETARY DISASSEMBLY AND ASSEMBLY

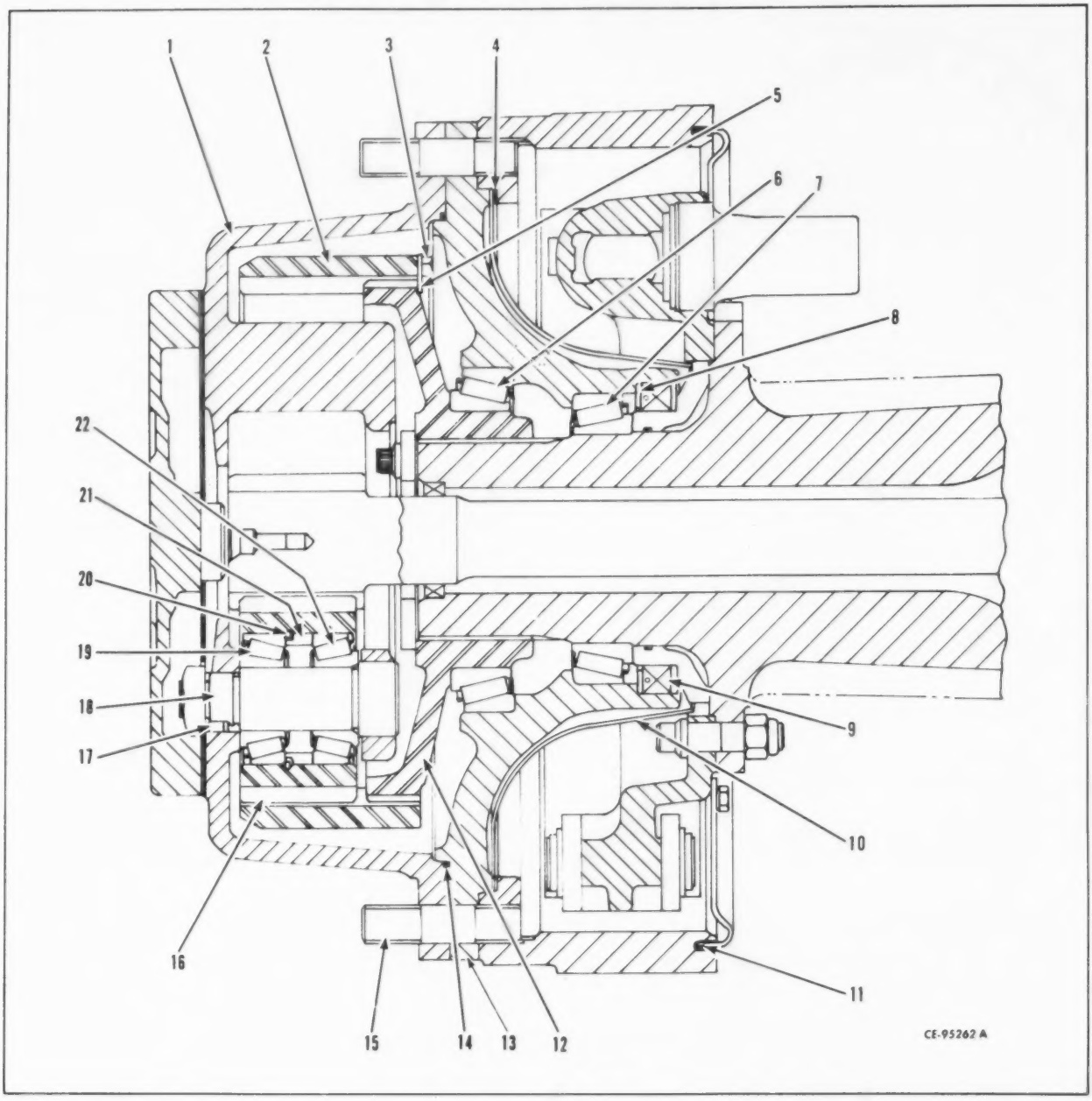


Figure 6-50
Planetary Assembly - Cross Section.

1. Planetary carrier.
2. Ring gear.
3. Cap screw.
4. Seal ring.
5. Lock plate.
6. Outer wheel hub bearing.
7. Inner wheel hub bearing.
8. Spacer.
9. Oil seal (0 = seal spring).
10. Scavenger.
11. Felt brake drum seal.
12. Ring gear hub.
13. Wheel hub.
14. Seal ring.
15. Wheel stud.
16. Pinion gear.
17. Dowel pin.
18. Planetary pinion shaft.
19. Pinion bearing.
20. Retaining ring.
21. Spacer.
22. Pinion bearing.



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## PLANETARY DISASSEMBLY AND ASSEMBLY

### CARRIER

DISASSEMBLY

Remove hex nuts (2, Fig. 6-51) from planetary pinion shafts (1).

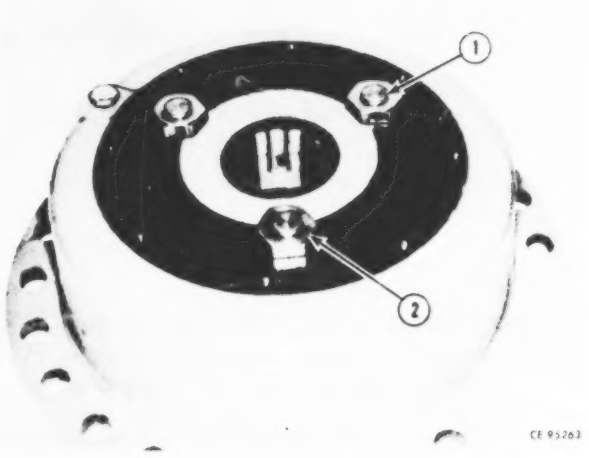



Figure 6-51

Press planetary pinion shafts (3, Fig. 6-52) from planetary carrier (1) using a hydraulic press. Exert pressure on small end of pinion shafts.

NOTE: Do not lose dowel pins (4) as pinion shafts are removed.

After pressing all pinion shafts from carrier, assembled pinion gears and bearings (2) may be removed.

Inspect pinion bearings (1, 7, Fig. 6-53). Check for smooth, free rotation. If the bearings do not operate properly, remove the bearing cups (2, 6), spacer (5) and snap ring (3) from pinion gears.

NOTE: Bearing cones and cups must be replaced together.

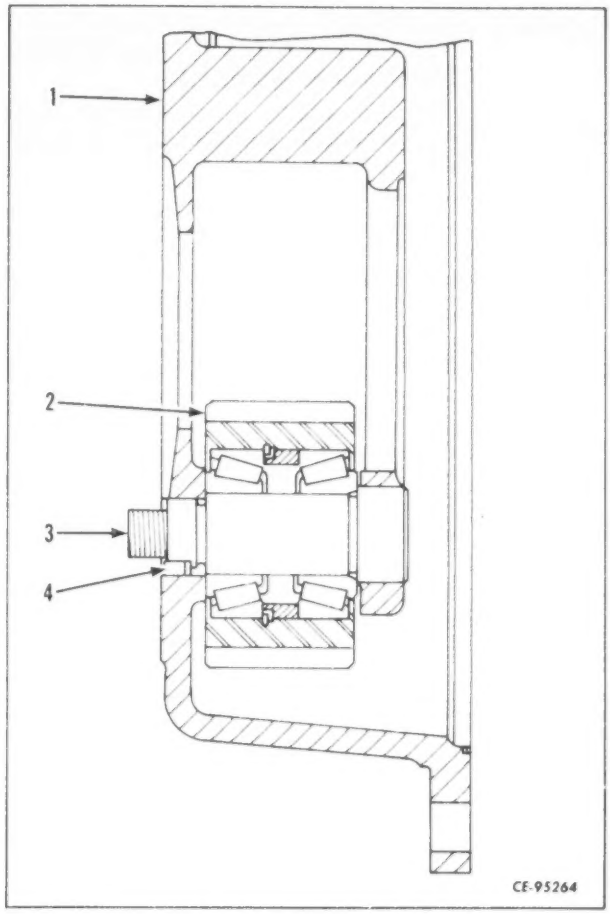



Figure 6-52

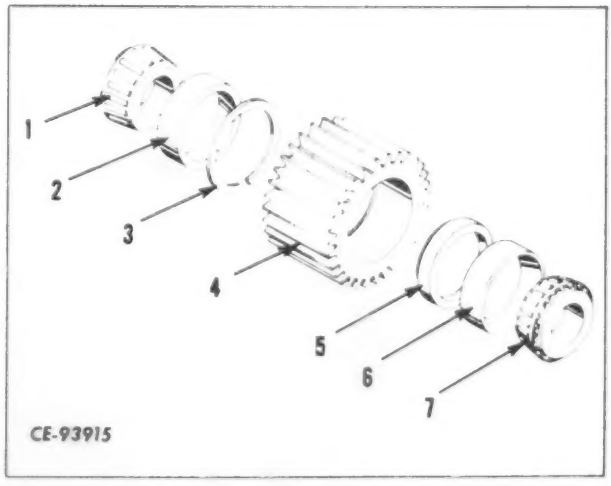



Figure 6-53

(Continued on next page)

## PLANETARY DISASSEMBLY AND ASSEMBLY

### CARRIER - Continued

#### CLEANING AND INSPECTION

Clean all parts thoroughly in solvent. Dry parts with compressed air.

CAUTION: NEVER dry bearings by spinning with compressed air.

Inspect all bearings, cups and cones, including those not removed.

Inspect pinions for wear or damage. Pinions showing wear or damage should be replaced.

Inspect pinion shafts for wear or ridging.

Replace all snap rings, gaskets, "O" rings and sealing washers.

Parts to be assembled immediately should be dipped in light oil to prevent corrosion. Parts to be stored should be coated with a good grade of rust preventive and wrapped in treated paper.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

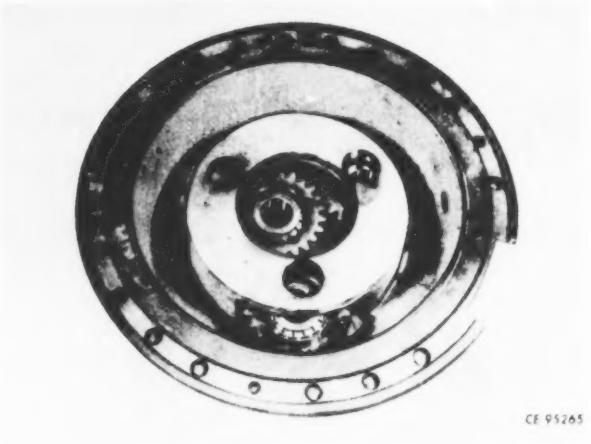
#### ASSEMBLY

Install a new snap ring (3, Fig. 6-53) in groove in pinion bore.

Install spacer (5) against snap ring. Press in bearing cups (2, 6).

Install bearing cones (1, 7) in cups with spacer (5) between cones.

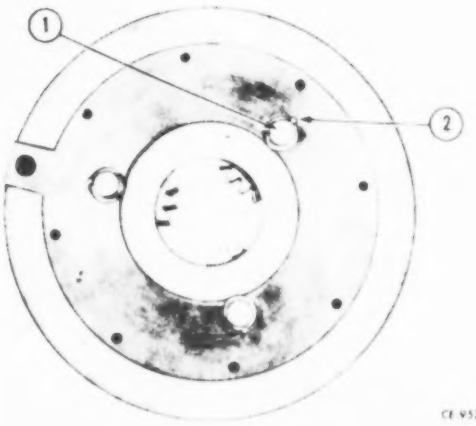
Slide assembled pinions (Fig. 6-54) into carrier in their approximate positions. All three must be installed before any shafts are installed. Align holes of pinion bearings and planetary carrier.



CE 95265

Figure 6-54

Pack pinion shafts in dry ice to shrink them for easier installation. With assembled pinions in position, install pinion shafts (1, Fig. 6-55), aligning dowel holes, and drive shafts into position. Install dowels (2) and drive into position against shoulder of shaft.




CE 95266

Figure 6-55

Install pinion nuts (1, Fig. 6-56) and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

Position nuts to fit inside I. D. of gasket (2) to provide clearance to install cover.

## PLANETARY DISASSEMBLY AND ASSEMBLY

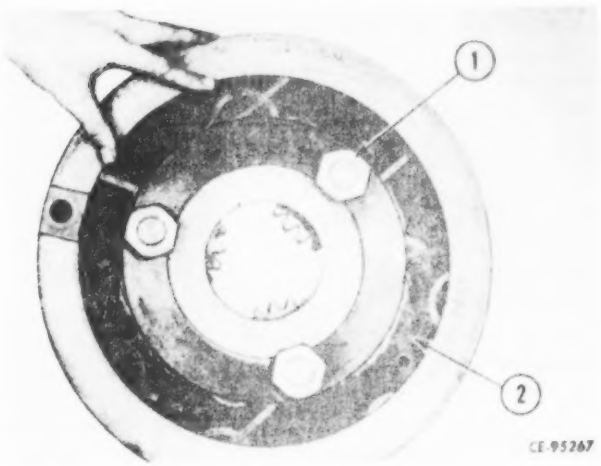



Figure 6-56

NOTE: In order to correctly position nuts, it may be necessary to vary torque above or below that specified.

### RING GEAR AND HUB

DISASSEMBLY

Remove cap screws (4, Fig. 6-57) and lock plates (3) that secure ring gear (1) to ring gear hub (2). Remove ring gear.

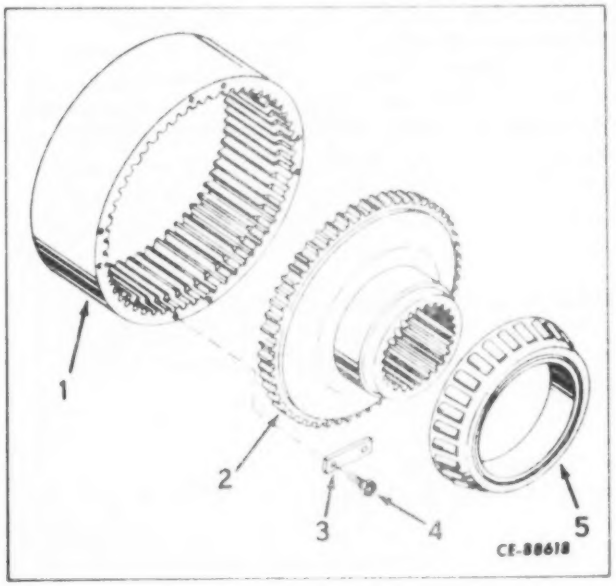



Figure 6-57

Using a suitable puller, remove bearing cone (5) from ring gear hub.

Wash all parts in fresh cleaning solvent. Inspect parts and replace if worn or damaged in any way.

ASSEMBLY

Chill ring gear hub (2, Fig. 6-57) in dry ice for 30 minutes. Install bearing cone (5) against shoulder of hub.

Position ring gear (1) on hub. Secure assembly with lock plates (3) and cap screws (4). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES" under "SERVICE INFORMATION").

Torque: _____

### WHEEL HUB AND BEARING

DISASSEMBLY

Remove seal (6, Fig. 6-58) and spacer (5) from hub. Discard oil seal.

Remove bearing cone (4) from hub. Mark bearing cup and cone so pair can be rematched if they are reused. Examine bearing cone and cups for wear or damage. Check rollers for flat or worn spots.

(Continued on next page)

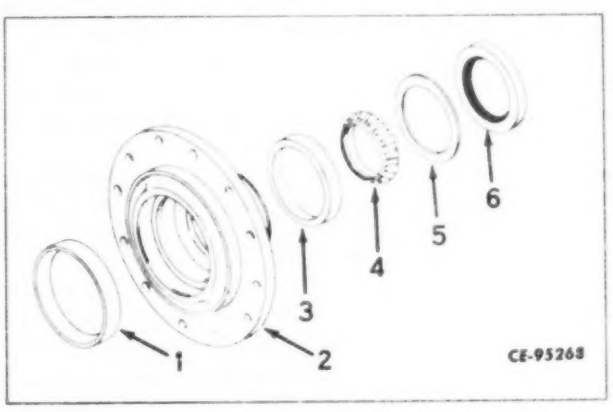



Figure 6-58

## PLANETARY DISASSEMBLY AND ASSEMBLY

### WHEEL HUB AND BEARING - Continued

DISASSEMBLY - Continued

Wash all parts in fresh cleaning solvent. Dry with compressed air.

CAUTION: NEVER dry bearings by spinning with compressed air.

Dip cones in light oil and check for wear, flat spots or damage. If cups or cones are damaged, or worn, replace complete bearing. Remove damaged bearing cup(s) (1 and/or 3) by pressing from hub.

ASSEMBLY

If bearing cups (1, 3, Fig. 6-58) were removed from hub (2), press new cups in hub. Lubricate bearing cone (4) with new axle lubricant (refer to "LUBRICANTS AND CAPACITIES" under "SERVICE INFORMATION") and install it in bearing cup (3) in hub.

Install spacer (5) against hub shoulder.

Coat O. D. of a new seal (6) with Mar-Seal or equivalent sealant. Press new seal in hub against spacer.

### BRAKE DRUM

DISASSEMBLY

If scavenger (3, Fig. 6-59) is damaged and requires replacement, drive it from drum assembly with a heavy mallet. Remove seal ring (4, Fig. 6-50) that lies between scavenger and brake drum. Discard seal and scavenger.

Remove felt seal (1, Fig. 6-59) from its groove in brake drum (2). Discard seal.

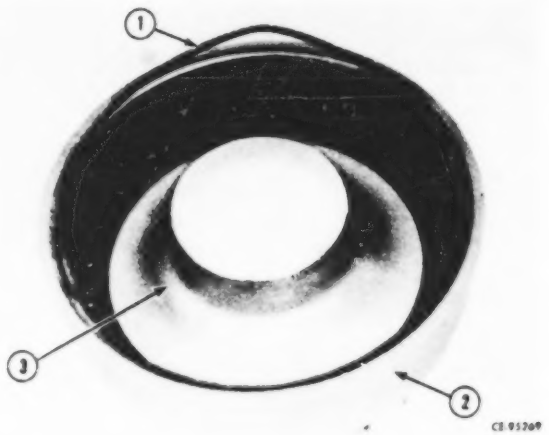



Figure 6-59

If any wheel studs are damaged, replace them. In addition, replace studs on either side of damaged stud. If approximately half of the studs are damaged, replace all studs on that drum.

ASSEMBLY

Replace necessary wheel studs as described above.

Install a new seal (4, Fig. 6-50) on drum shoulder of drum. Position a new scavenger (3, Fig. 6-59) on drum and tap edges lightly to start scavenger into bore. Position a hardwood block across FULL DIAMETER of scavenger and using a mallet drive scavenger into position. Rotate block while striking it with mallet. Be sure scavenger is seated around its entire circumference against drum shoulder.

Install a new drum seal (1, Fig. 6-59) in drum groove. Do not damage or distort seal during installation. Seal must not be twisted during installation.

## TROUBLE SHOOTING

Noise and vibration, originating in the transmission, drive shafts or tires is often attributed to an axle. The source of noise should be investigated before deciding that the cause is in the axle.

Axle noise may be isolated within the axle by jacking up the tractor so the tires clear the ground. If the noise is in one axle, disconnect the drive shaft of the opposite axle at the transmission. Now the noise may be isolated with only the noisy axle turning. Run the engine at a moderate speed with the transmission in first gear. Both wheels must be off the ground to prevent damage to the differential.

CAUTION: If a failure should occur in the differential, the tractor must not be operated under its own power. If the tractor must be moved, disconnect the drive shaft at the transmission, or remove the drive shaft completely. Drain both planetary hubs of the noisy axle, remove the planetary covers and pull the axle shafts to prevent further damage. When shafts are removed, install planetary covers and fill hubs before moving tractor. The tractor may be driven a short distance with one axle if the drive shafts and axle shafts are removed from the noisy axle or differential.

### TROUBLE SHOOTING CHART

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| | AXLE | |
| Noise. | 1. Incorrect lubricant, or level too low.<br>2. Wheel bearings scored or damaged.<br>3. Wheel bearings improperly adjusted.<br>4. Sun gear teeth excessively worn or damaged. | |
| Loss of lubricant. | 1. Lubricant level too high.<br>2. Lubricant foams excessively.<br>3. Lubricant leaks at planetary cover.<br>4. Worn or broken oil seal on axle spindle housing (oil leak from behind wheel into brake compartment).<br>5. Worn or broken drive axle oil seal (oil level in differential rises). | 2. Drain and fill with correct type and viscosity of oil. |

(Continued on next page)

## TROUBLE SHOOTING

### TROUBLE SHOOTING CHART - Continued

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| | DIFFERENTIAL | |
| Noise when turning. | 1. Worn spider gears or side gears. | |
| Loss of lubricant. | 1. Worn drive pinion oil seal.<br>2. Scored or worn differential drive yoke. | |
| Differential overheats. | 1. Incorrect lubricant or level too low.<br>2. Pinion or ring gear bearing worn.<br>3. Gear teeth excessively worn or damaged.<br>4. Unmatched pinion and ring gear. | 4. Replace with a new matched pinion and ring gear. |
| Noise when driving. | 1. Incorrect lubricant or level too low.<br>2. Pinion and ring gear adjustment too tight. | 2. Readjust pinion and ring gear backlash. |
| Noise when coasting. | 1. Pinion or ring gear bearings damaged.<br>2. Pinion and ring gear adjustment too loose. | 2. Readjust pinion and ring gear backlash. |
| NOTE: The following problems can be checked when the differential has been removed and disassembled. | | |
| Side gear broken at hub. | 1. Misaligned or bent drive axle.<br>2. Worn thrust washers. | 1. Replace damaged gears. Check drive axle for alignment and examine other gears and bearings for possible damage and replace as needed.<br>2. Examine other gears and bearings for possible damage. |

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## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Gears scored. | 1. Incorrect lubricant or level too low.<br>2. Excessive wheel spinning. | 2. Inspect all gears, pinion bores and shafts for scoring. Inspect bearings for possible damage and replace as needed. |
| Pinion and/or ring gear tooth breakage. | 1. Improper pinion and ring gear adjustment (backlash).<br>2. Excessive shock loading of gears. | 1. Replace gears with new matched set.<br>2. Inspect remaining parts for possible damage and replace as needed. |
| PLANETARY | | |
| Noise. | 1. Planetary gears or ring gear teeth worn, chipped or broken.<br>2. Bearings in planetary gears worn or broken. | |
| BRAKES | | |
| Brakes drag. | 1. Brakes incorrectly adjusted.<br>2. Return springs broken.<br>3. Wedge return spring broken. | |

# SOLID AXLES

## SERVICE INFORMATION

### SPECIFICATIONS

#### AXLE

| | |
|---|---|
| Overall Length | 113" |
| Track - With Standard Wheels | 96" |

#### RATIOS

| | |
|---|---|
| Differential | 4.33 |
| Planetary | 5.2 |
| Total | 22.516 |

#### BRAKES

| | |
|---|---|
| Diameter of Brake Drum | 20.25" |
| Width of Brake Shoes | 4" |
| Brake Cylinder Diameter | 1.75" |

### LUBRICANTS AND CAPACITIES

| | REFILL CAPACITY | LUBRICANT | | |
|---|---|---|---|---|
| Differential (each) | 17 qts. | IH-135H EP OR MIL-L-2105B | GL-5 | Above 32° . . 140<br>Below 32° . . 90 |
| Planetaries (each) | 6-1/2 pts. | | | |

### TOLERANCES

| | |
|---|---|
| Additional shim pack; planetary ring gear hub retainer-to-axle housing spindle | .005" |
| Preload torque limits - differential pinion cage | 2-6 lbs. -pull |
| Initial backlash - new ring and pinion gear set | .010" |
| Backlash alteration limits - permissible during adjustment | .008"-.015" |
| Thrust block clearance | .010"-.015" (1/4 turn of adjusting screw) |



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## SERVICE INFORMATION

### SPECIAL TORQUES

(Threads lubricated with oil or grease)

| | |
|---|---|
| Differential mounting cap screws | 150-175 ft. lbs. |
| Brake spider-to-axle flange nuts | 175-180 ft. lbs. |
| Ring gear hub retainer cap screws: | |
| Preliminary torque | 40 ft. lbs. |
| Final torque | 200 ft. lbs. |
| Planetary carrier-to-wheel hub, flat head cap screws | 80-90 ft. lbs. |
| Planetary cover-to-carrier cap screws | 105-115 ft. lbs. |
| Axle mounting cap screws | 3500 ft. lbs. |
| Differential: | |
| Pinion nut torque | 500-700 ft. lbs. |
| Pinion cage/cover retaining cap screws | 150-175 ft. lbs. |
| Ring gear to case half cap screws | 190-200 ft. lbs. |
| Case half retaining cap screws | 135-155 ft. lbs. |
| Bearing cap bolts | 350-425 ft. lbs. |
| Planetary pinion shaft retaining nut | 450 ft. lbs. |
| Planetary ring gear-to-ring gear hub retaining cap screws | 33-37 ft. lbs. |
| Wheel lug nuts | 875-925 ft. lbs. |

*Wheel lug nuts must be torqued dry.

### BRAKE ADJUSTMENT

Refer to Section XIII, "BRAKE SYSTEM."

### SPECIAL TOOLS

AXLE REMOVAL AND INSTALLATION TOOL

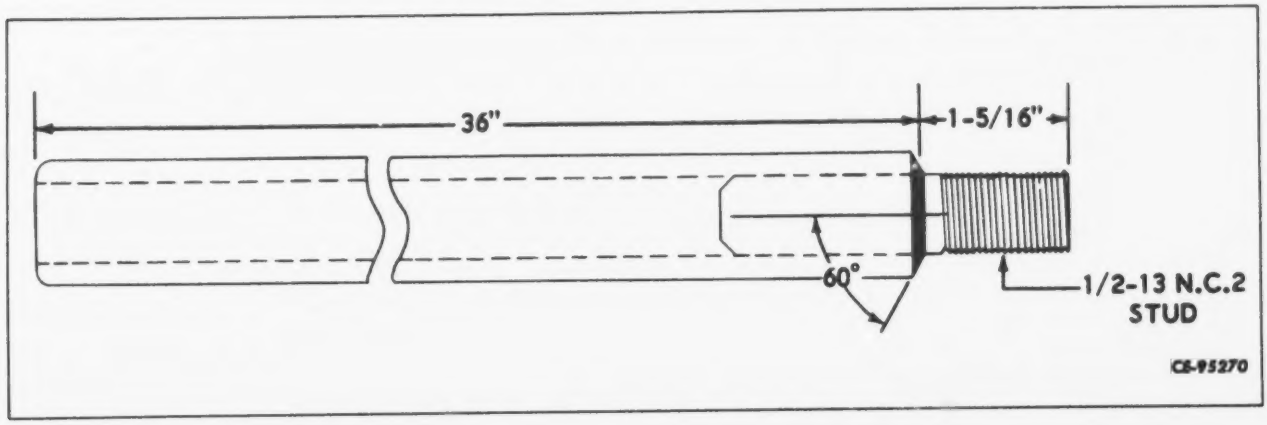


Figure 6-60

(Continued on next page)

## SPECIAL TOOLS - Continued

DIFFERENTIAL HOLDING FIXTURE

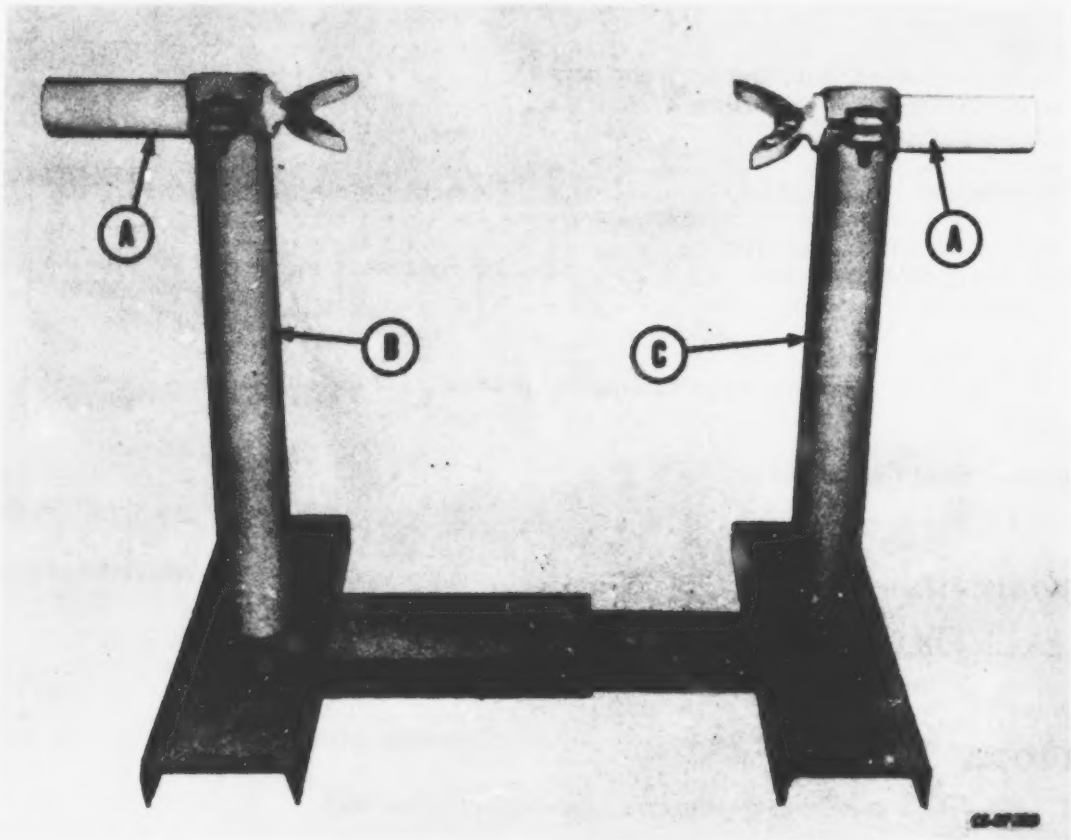


Figure 6-61
Assembled Differential Holding Fixture.

A. Swivel weldment (Fig. 6-62).

B. Stand weldment - left hand (Fig. 6-63).

C. Stand weldment - right hand (Fig. 6-64).

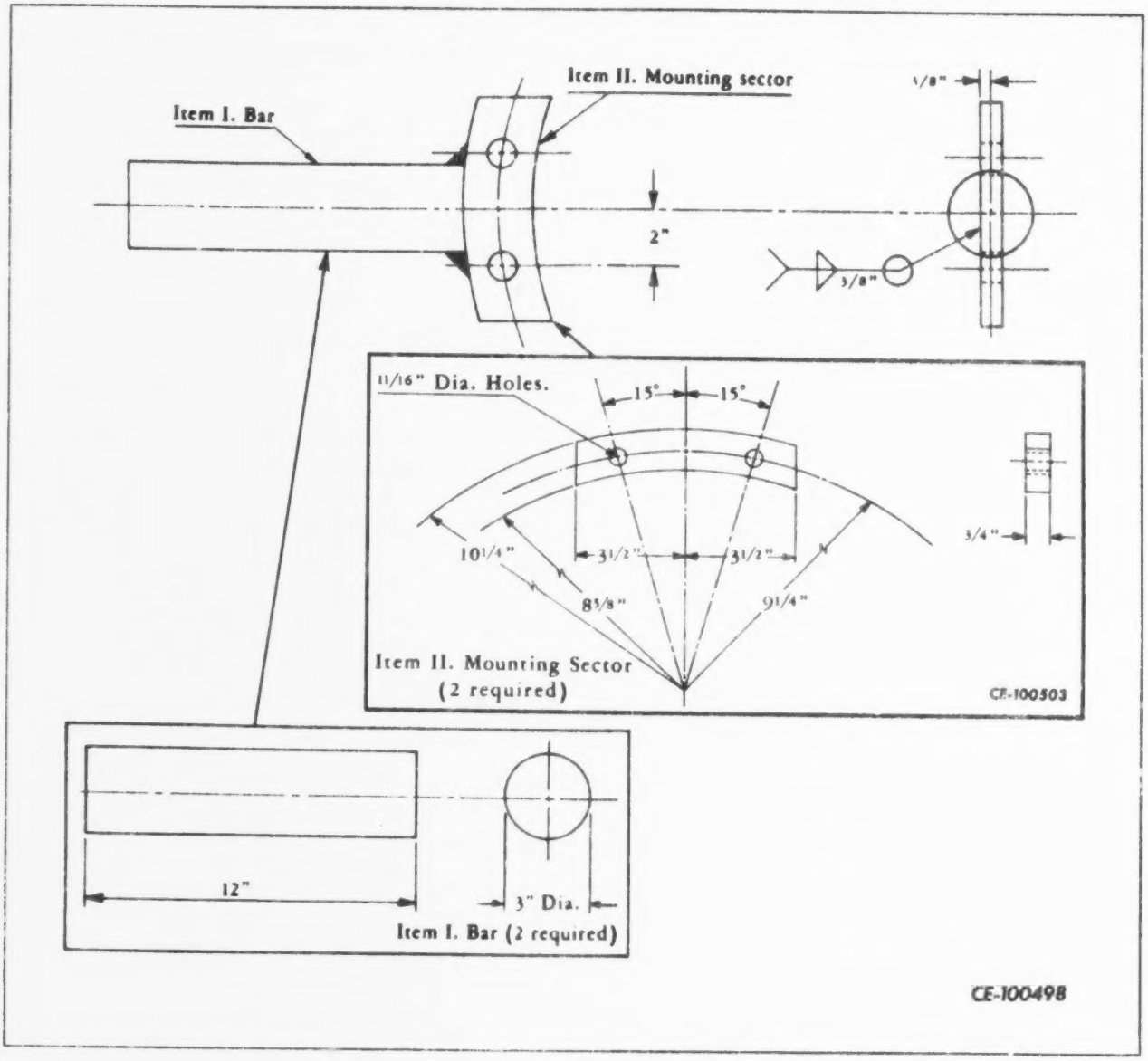


Figure 6-62
A. Swivel Weldment (2 Required).

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## SPECIAL TOOLS - Continued

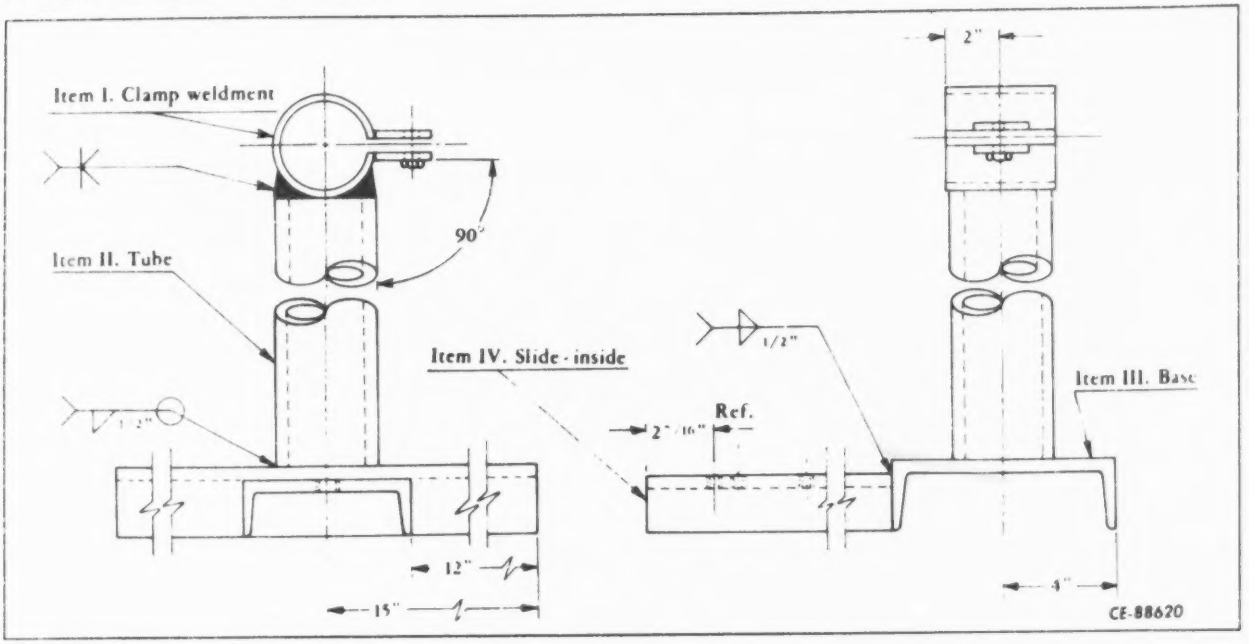


Figure 6-63
B. Stand Weldment Assembly - Left Hand (1 Required).
(Details Shown in Figures 6-65, 6-66, 6-67 and 6-69)

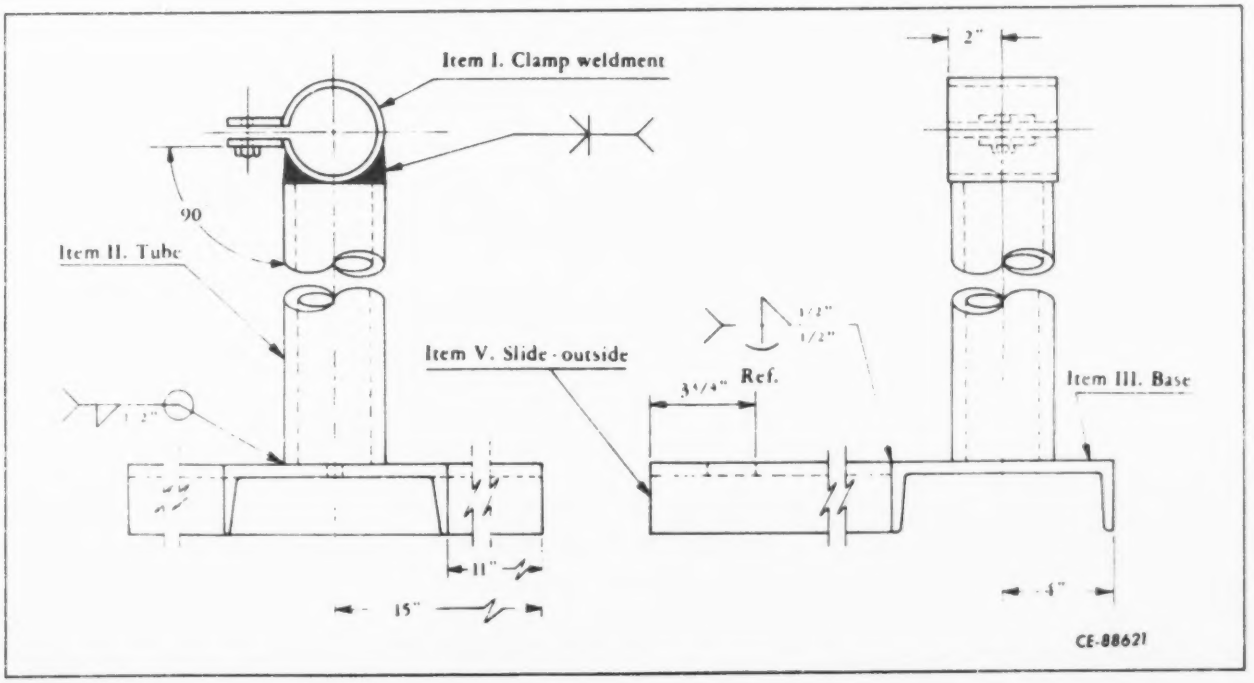


Figure 6-64
C. Stand Weldment Assembly - Right Hand (1 Required).
(Details Shown in Figures 6-65, 6-66, 6-67 and 6-68)

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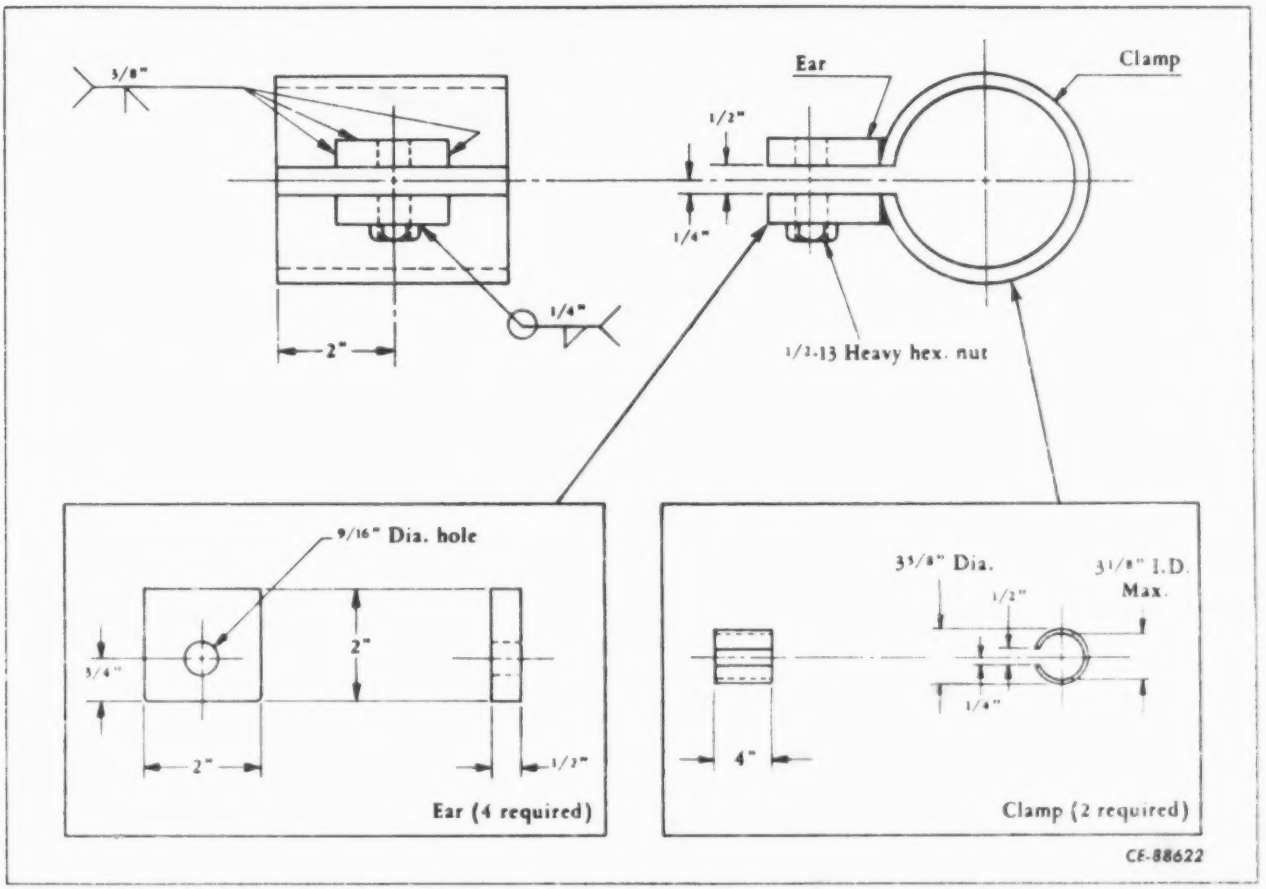


Figure 6-65
Item I. Clamp Assembly (2 Required).

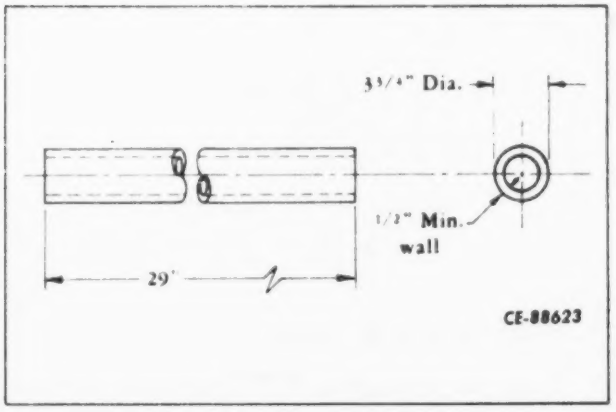


Figure 6-66
Item II. Tube (2 Required).

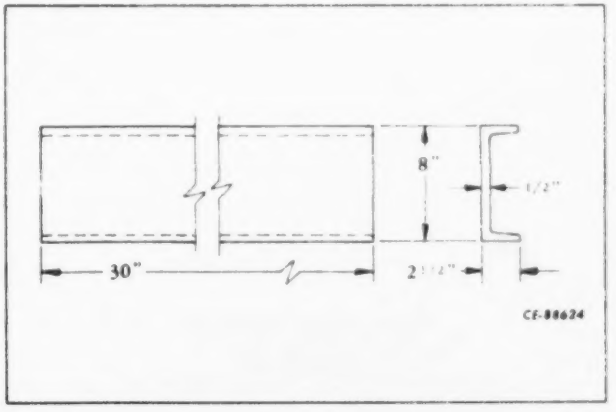


Figure 6-67
Item III. Base (2 Required).

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## SERVICE INFORMATION

### SPECIAL TOOLS - Continued

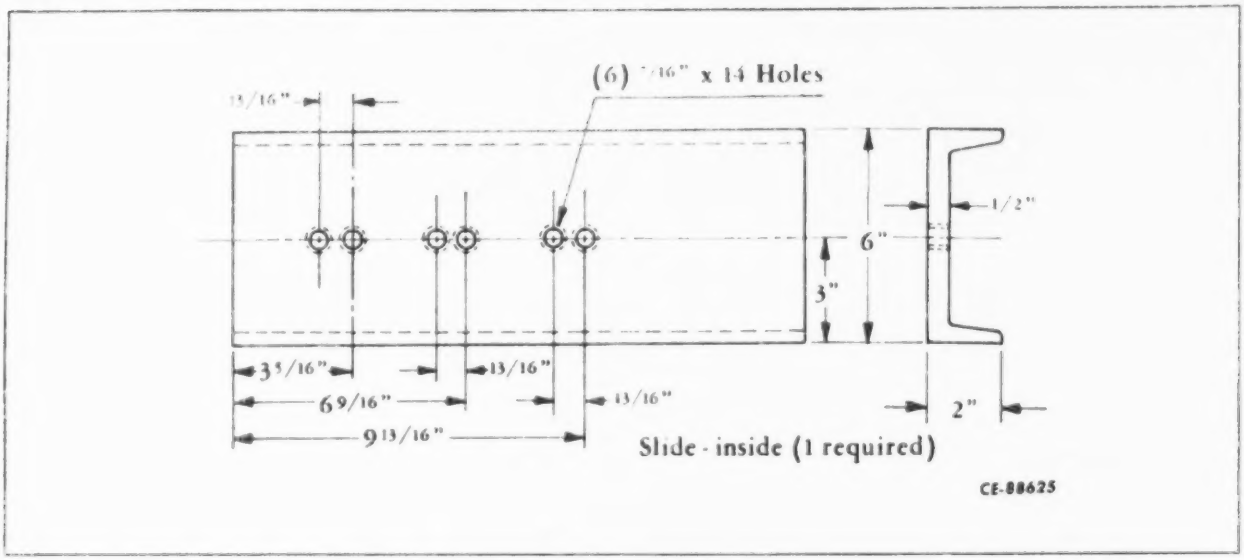


Figure 6-68
Item IV. Slide-Stand Weldment (Right Hand).

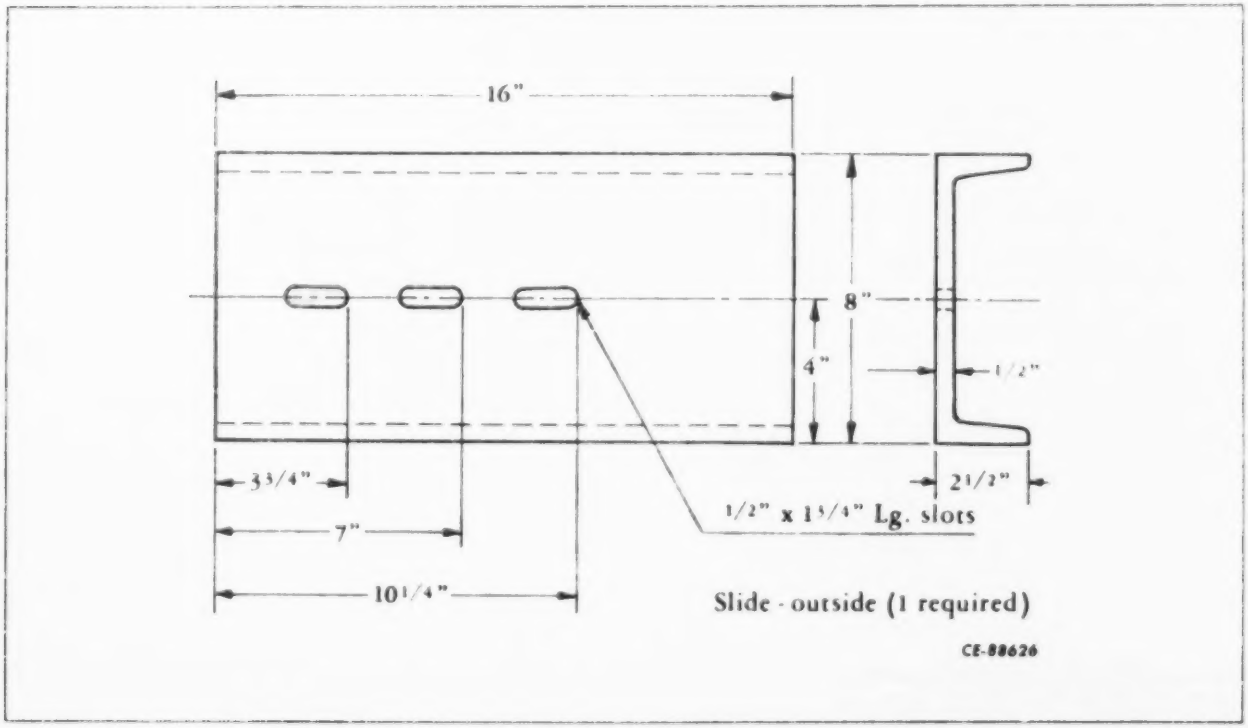


Figure 6-69
Item V. Slide-Stand Weldment (Left Hand).

WHEEL HUB - BRAKE DRUM LIFTING TOOL

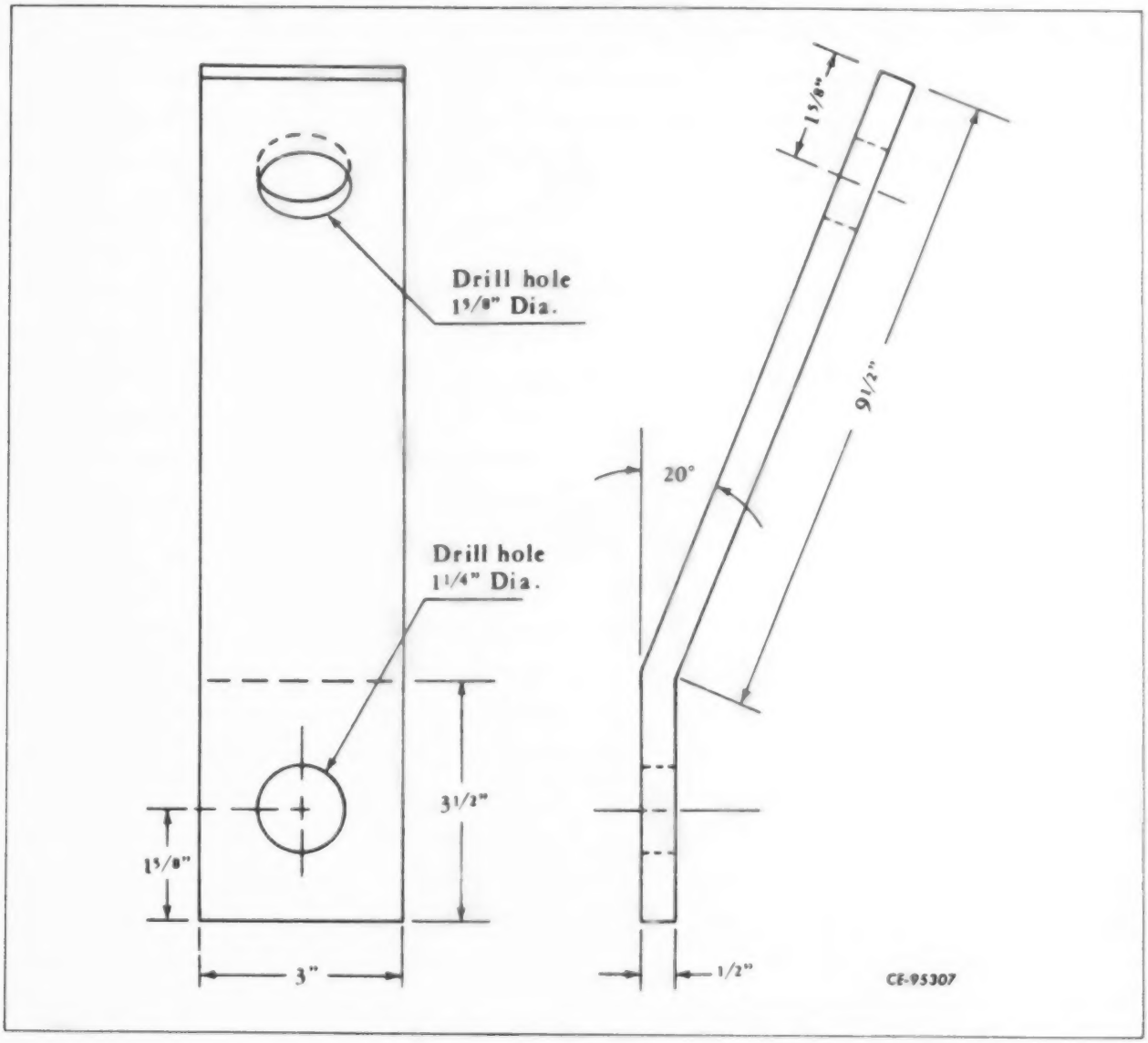


Figure 6-70

# SOLID AXLES

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
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# SECTION VII
# STEERING AXLES

(Not Applicable)

# SECTION VIII
# STEERING GEAR

Page

SECTION VIII STEERING GEAR


General Information . . . . . 1
Description . . . . . 2
Preventive Maintenance . . . . . 2
Required Tools . . . . . 2

Disassembly, Inspection and Assembly . . . . . 2
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Steering Column . . . . . 7

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Service Information . . . . . 10
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Lubricants and Capacities . . . . . 10
Special Torques . . . . . 10
Adjustments . . . . . 10

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## GENERAL INFORMATION

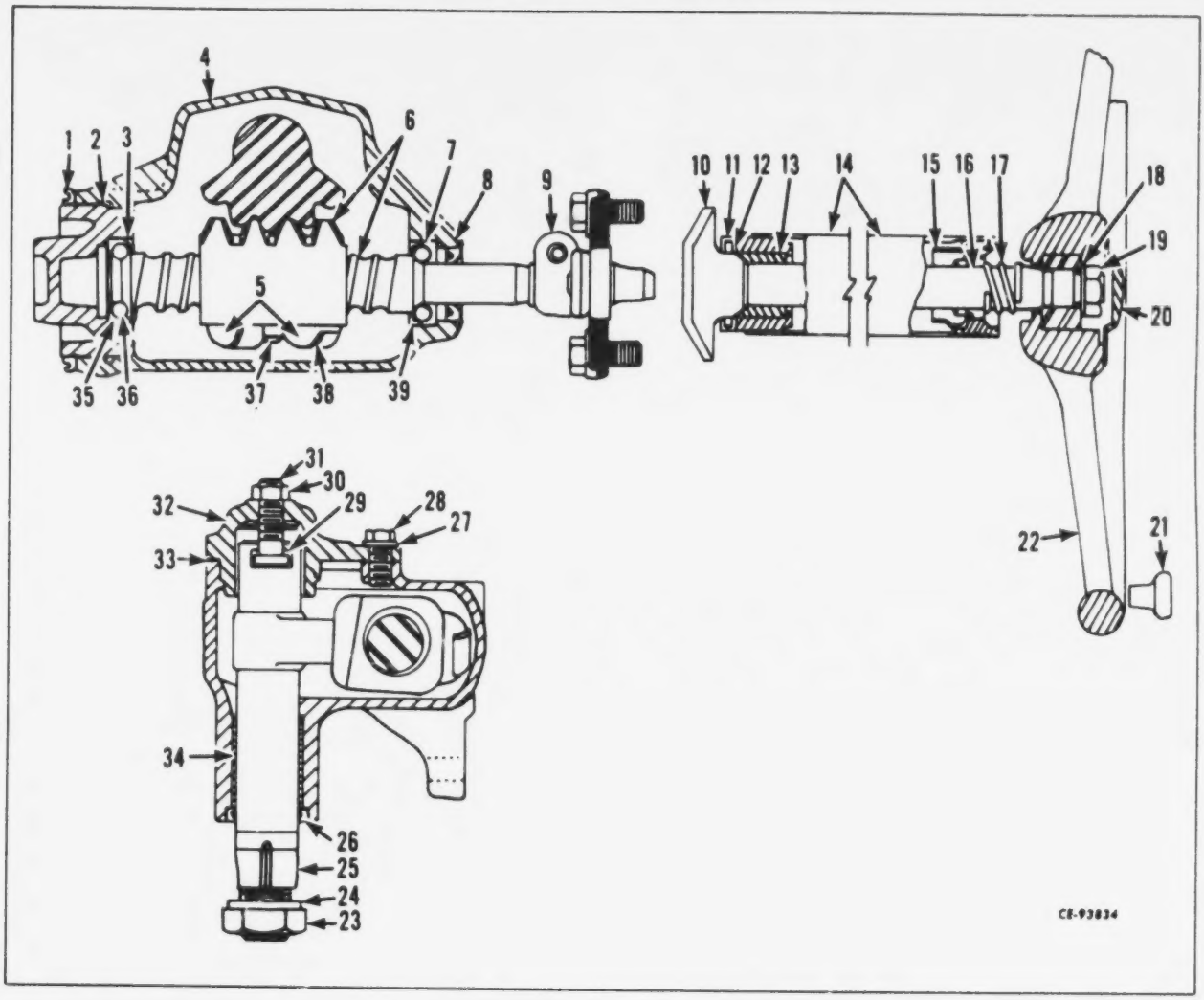


Figure 8-1
Steering Gear - Cross Section.

1. Adjuster lock nut.
2. Bearing adjuster.
3. Bearing retainer.
4. Housing.
5. Ball return guide.
6. Shaft and nut.
7. Bearing cup.
8. Seal.
9. Flange.
10. Steering shaft.
11. Seal retainer.
12. Seal.
13. Bushing.
14. Jacket.
15. Bearing.
16. Spring seat.
17. Spring.
18. Washer.
19. Nut.
20. Cap.
21. Spinner knob.
22. Steering wheel.
23. Pitman arm nut.
24. Washer.
25. Gear and shaft.
26. Seal.
27. Washer.
28. Cap screw.
29. Shim.
30. Nut.
31. Lash adjuster.
32. Side cover.
33. Gasket.
34. Bushing.
35. Bearing cup.
36. Bearing.
37. Screw and washer.
38. Guide clamp.
39. Bearing.

# STEERING GEAR

## GENERAL INFORMATION

### DESCRIPTION

The steering gear is a recirculating ball bearing, worm and nut type.

The recirculating ball type gear consists of a "ball nut" connected to the steering worm and in mesh with the sector gear. Precision finished helical grooves within the ball nut match helical grooves in the worm. The ball bearings roll within these grooves when the steering wheel is turned. There are two complete circuits using tubular ball guides to deflect the balls away from their helical path at one end of the grooves and guide them back to the other end.

### PREVENTIVE MAINTENANCE

Cleanliness, the correct type and sufficient lubricant are the most important maintenance requirements.

### REQUIRED TOOLS

Standard Mechanics Hand Tool Set

Torque wrench - 0-50 in. lbs. rating
Torque wrench - 0-200 ft. lbs. rating

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### STEERING GEAR

#### REMOVAL

Remove gear as follows:

a. Disconnect drag link from pitman arm. Remove pitman arm.

b. Disconnect flange from column.

c. Remove cap screws and lock washers securing gear to tractor.

d. Remove steering gear assembly from tractor.

#### DISASSEMBLY

Place gear assembly in vise.

NOTE: Do not clamp housing too tightly in vise as damage may result from excess pressure.

Scribe a mark (2, Fig. 8-2) on shaft in line with reference indicator on flange (1) to insure proper positioning of parts during assembly.

Remove flange.

Remove lock nut (4) from lash adjuster screw (3).

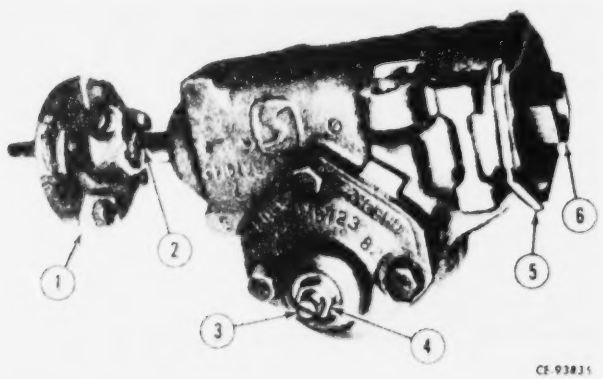


Figure 8-2

Turn lash adjuster screw (3) a few turns counterclockwise. This will remove load from worm bearings caused by close meshing of rack and sector teeth.

Loosen bearing adjuster nut (5) and remove adjuster (6) with ball bearing retainer and nut.

Remove cap screws and lock washers that secure side cover (1, Fig. 8-3) to housing (3).

Pull side cover with sector and shaft from housing.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

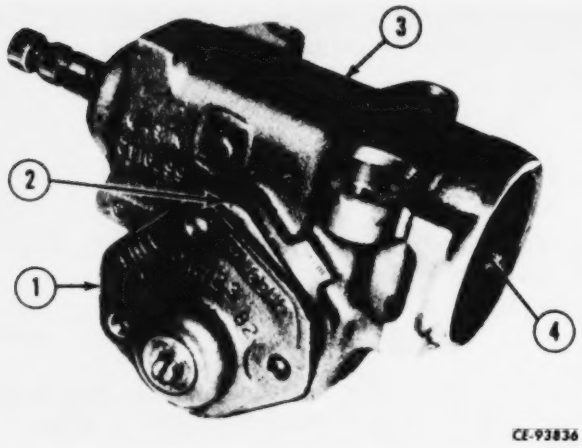


Figure 8-3

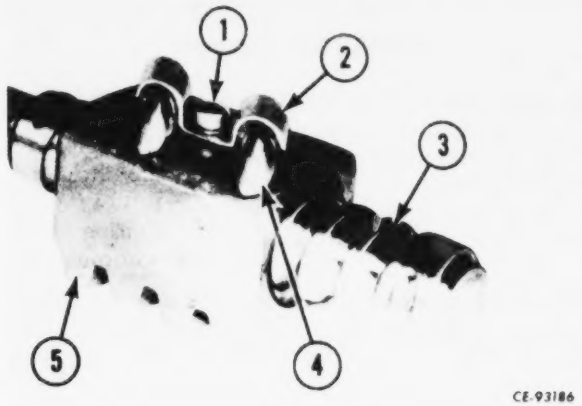


Figure 8-4

NOTE: If sector does not clear opening in housing easily, turn worm shaft by hand until sector will pass through opening.

Remove and discard cover gasket (2).

Carefully withdraw worm shaft (4) and ball nut as an assembly from housing assembly (3).

NOTE: If shaft with ball nut is held in vertical position, ball nut will travel by its own weight to end of shaft. If ball nut strikes either end of worm sharply, ball guides will be damaged. If ball nut does not require disassembly, tape each end of worm to prevent movement of ball nut.

Try action of ball nut on worm. Nut must rotate smoothly with no evidence of binding or roughness. If damage is evident, disassemble as follows (Fig. 8-4):

a. Remove screw (1) attaching ball guide clamp (2) to ball nut (5). Remove clamp. Pull ball guides (4) out of ball nut, one pair at a time. Separate guides and remove balls.

b. Turn ball nut upside down, rotate shaft (3) back and forth until all balls have dropped from ball nut into a clean pan. With balls removed, pull ball nut endwise from shaft worm.

Removal and replacement of housing bushing may be deferred until after inspection of parts.

Remove and discard seals (1 and 3, Fig. 8-6).

### CLEAN

Thoroughly clean all parts in clean solvent and dry with compressed air.

### INSPECTION

Inspect gear housing for cracks or stripped threads in tapped holes.

Check clearance between pitman shaft and bushing in housing. If bushing is worn, replace. Refer to "REPAIR."

Inspect upper and lower ball bearing. If damaged or worn replace.

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### STEERING GEAR - Continued

INSPECTION - Continued

Examine side cover for cracks or damage. Check clearance between pitman shaft and side cover bushing. If bushing is scored, damaged or excessively worn, replace side cover and bushing assembly.

Inspect pitman shaft for damaged splines and/or threads. Examine sector gear teeth for scuffing and scoring. Check shaft O.D. (1.12"). If excessive wear is evident at any of these points, replace shaft.

Inspect bearing areas and thread groove on worm. If worm is galled, replace steering shaft and ball nut assembly completely.

Check worm ball nut teeth for scuffing and scoring. Inspect holes and passages for obstructions. Check all worm balls for flat spots, wear or other damage. Balls must be the same size within 0.0001 inch.

Examine ball guides for distortion and bent pick-up fingers. Place two halves of guide together and try action of balls.

Inspect threads on lower end of worm gear. Threads must be clean and free of nicks and burrs.

REPAIR

To replace pitman shaft bushing (2, Fig. 8-5) press bushing from housing (1) using improvised tool.

Carefully press new shaft bushing (2, Fig. 8-6) into position using a suitable driver. Press bushing flush with edge of housing bore.

A tubular driver may be fabricated to install seals (1, 4) during the final assembly.

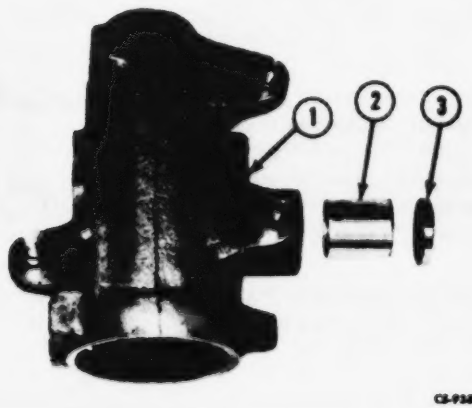


Figure 8-5

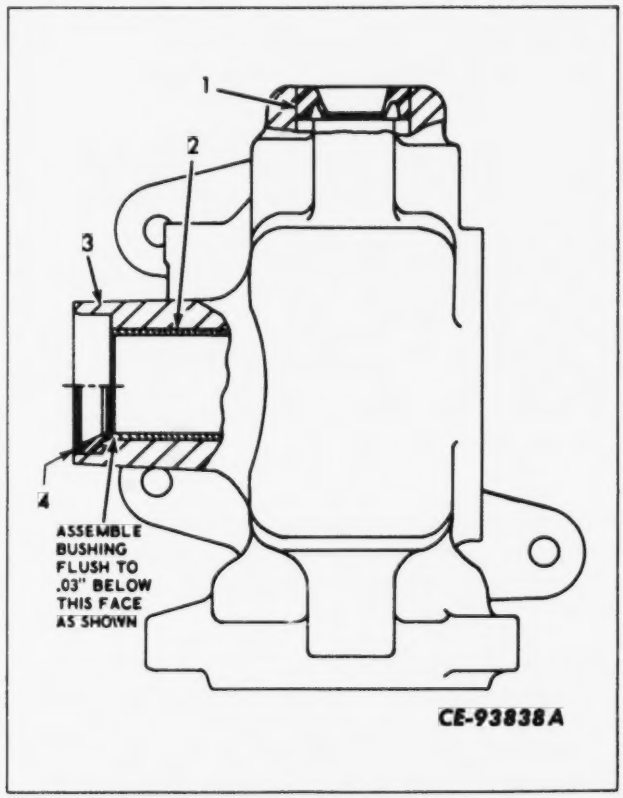


Figure 8-6



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Figure 8-7

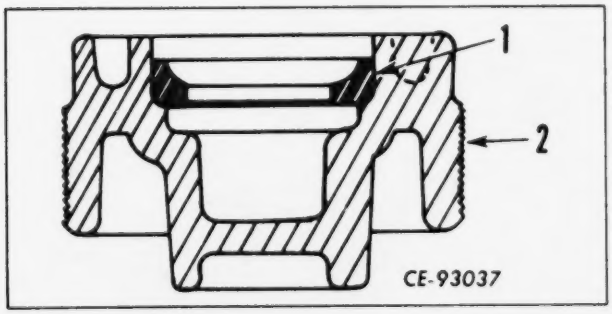


Figure 8-8

Pull old cup (1, Fig. 8-8) from adjuster (2). Carefully press a new cup into adjuster using a minimum of 7,000 lbs. force to seat cup.

### ASSEMBLY

One of the most important phases of assembling steering gear components is cleanliness. All parts must be kept clean. Any abrasive material remaining in housing during assembly will

(Continued on next page)

## STEERING GEAR - Continued

ASSEMBLY - Continued

quickly damage mechanism. Grease and oil used during assembly must be free from dirt or other contaminates. Prelubricate all bearings and moving parts with "Lubriplate" or equivalent.

Place worm shaft assembly horizontal on clean work bench. Place ball nut over worm with return guide holes in nut facing up. Align groove in worm and ball nut by sight. (Fig. 8-9.)

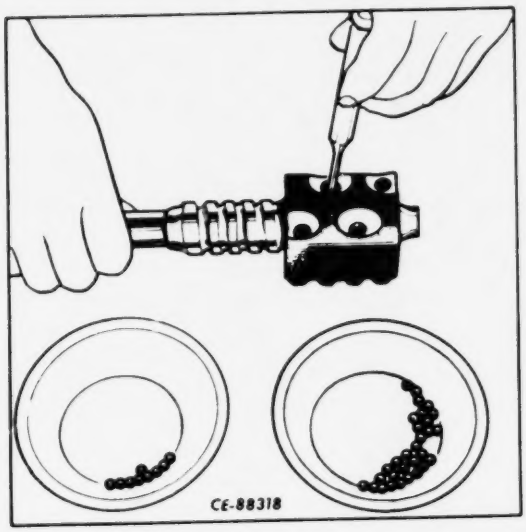


Figure 8-9

Count one-half of total amount of balls into a clean container.

Drop balls into one of the ball return guide holes. Slowly rotate worm away from that hole while inserting balls. Continue until circuit is filled from bottom of one hole to bottom of the other, or until stopped by reaching end of worm.

If balls are stopped at end of worm, hold down balls already installed with a rod or punch. Rotate shaft in a reverse direction a few turns. Filling of circuit may then be continued. It may be necessary to work shaft back and forth holding balls down first in one hole and then in the other. This will close-up spaces between balls, filling the circuit completely.

Lay one half of ball guide, groove up, on bench. Place remaining balls into groove of guide. Cover assembly with opposite half of guide. Hold two halves together and plug each end with vaseline to prevent balls from dropping out while installing guide. (Fig. 8-10.)

Figure 8-10

Push ball return guide completely into holes in ball nut (Fig. 8-11). If guide does not push down all the way easily, tap it lightly into place with wooden handle of a screwdriver. This completes one circuit of balls.

Fill remaining circuit with balls in same manner described above.

Install ball return guide clamp (2, Fig. 8-4) on ball nut with screw (1).

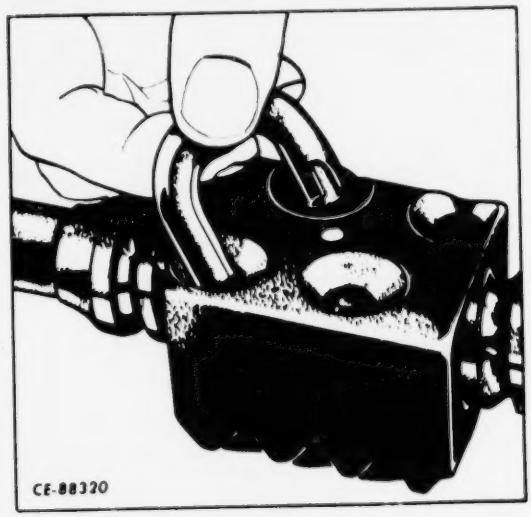


Figure 8-11

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Be certain ball nut and balls are thoroughly lubricated. Test assembly by rotating ball nut on worm. Do not rotate ball nut to end of worm threads. Assembly must move freely. Temporarily tape shaft at both ends of ball nut until ready to install assembly in housing.

Remove tape. Grasp worm below and above ball nut to prevent nut from running to extreme ends. Insert worm shaft through lower opening in gear housing and guide shaft carefully through upper housing bearing.

Place original shim (3, Fig. 8-12) on lash adjuster screw (2). Insert adjuster screw and shim into slotted end of pitman shaft (1).

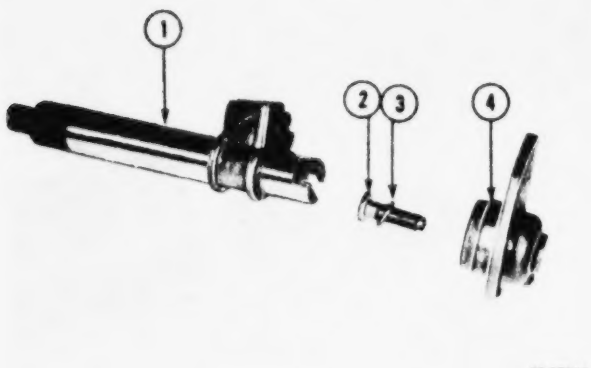


Figure 8-12

Check clearance between screw head and shaft. Clearance must not exceed .002 in. If clearance is greater, select a thicker shim. Four sizes are available. (Fig. 8-13.)

With lash adjuster screw and shim in place in slotted end of pitman shaft, start side cover (4, Fig. 8-12) over end of shaft. Engage screw slot with screwdriver using hole in side cover.

Rotate worm shaft until ball nut is in approximate center of worm. Center tooth of sector gear must enter center tooth space of ball nut.

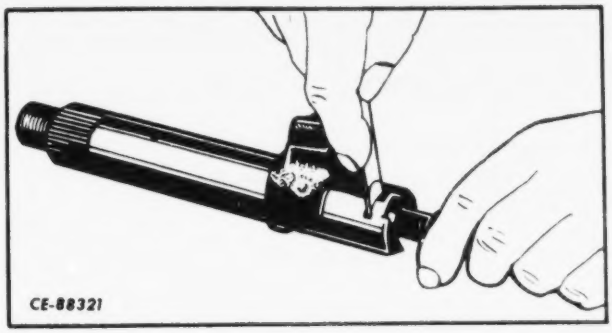


Figure 8-13

With new gasket (2, Fig. 8-3) in place on side cover (1), insert pitman shaft into housing (3), meshing teeth as described above. Rotate lash adjuster screw to pull cover over end of shaft. Back off adjuster screw to permit lash (play) between sector gear and ball nut.

Install side cover bolts with lock washers and tighten to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

Place lower ball bearing in adjuster and secure with retainer. Thread adjuster (6, Fig. 8-2) into housing until snug. Be sure bearing is seated on end of shaft. Install nut (5) but do not tighten.

Lubricate steering gear assembly. Refer to "LUBRICANTS AND CAPACITIES."

Install steering gear on tractor. Adjust gear. Refer to "ADJUSTMENTS."

## STEERING COLUMN

### REMOVAL

Remove button plug from steering wheel.

Remove nut, washer, and spring securing steering wheel. Remove steering wheel. Reinstall spring, washer and nut.

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### STEERING COLUMN - Continued

REMOVAL - Continued

Disconnect column from flange on steering gear. Remove "U" bolt securing column to frame. Remove steering column.

DISASSEMBLY

Remove nut (1, Fig. 8-14), washer (2), spring (3), seat (4) and bearing (5), from column jacket (6).

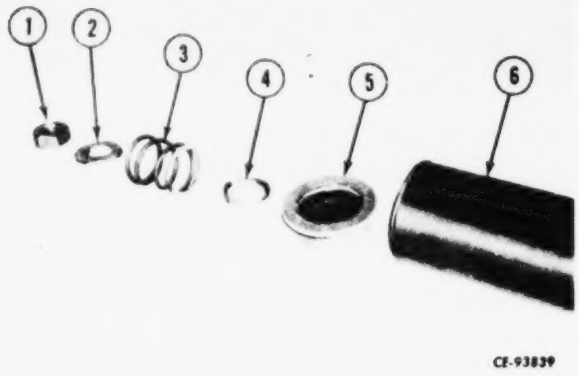


Figure 8-14

Slide shaft (1, Fig. 8-15) from column jacket (2).

Remove retainer (1, Fig. 8-16) and seal (2). Pull old bushing (3) from column jacket (4).

INSPECTION

Thoroughly clean all metal parts in clean solvent and dry with compressed air.

Inspect column upper bearing and lower bushing. Replace if necessary.

ASSEMBLY

Press bushing (3, Fig. 8-16) into column jacket (4). Install seal (2) and retainer (1).

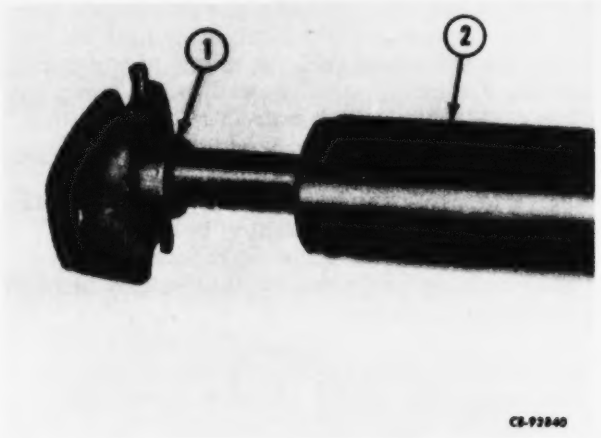


Figure 8-15

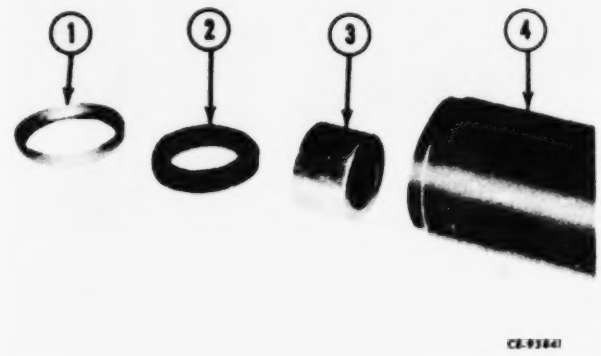


Figure 8-16

Slide shaft (1, Fig. 8-15) into jacket (2) being careful not to damage bushing.

Install bearing (5, Fig. 8-14) into jacket (6). Install seat (4), spring (3), washer (2) and nut (1) on shaft.

INSTALLATION

Install column on frame and secure with "U" bolts. Connect column to flange. Torque the nuts. Refer to "SPECIAL TORQUES."

Torque: _____



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## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Steering wheel stops turning before tractor halves hit stop blocks. | 1. Steering gear not centered. | |
| Play in steering gear. | 1. Worn gears in steering gear housing.<br>2. Sector shaft gear lash out of adjustment. | |
| Hard steering while driving. | 1. Frozen hinge pin bearings.<br>2. Steering adjustment tight.<br>3. Tires under inflated. | 2. Check adjustment by removing pitman arm from sector shaft or disconnecting linkage from pitman arm ball. Adjust if necessary. |
| Poor steering return. | 1. Frozen hinge pin bearings.<br>2. Tires not inflated properly.<br>3. Tight steering linkage.<br>4. Steering adjustment tight. | |
| Gear noise (rattle or chuckle). | 1. Loose over-center adjustment.<br>NOTE: A slight rattle may occur on turns because of the increased lash on either side of the high point.<br>2. Gear mounting loose. | |
| Hard steering when turning slowly. | 1. Lack of lubrication in linkage.<br>2. Tires not properly inflated. | |
| Excessive wheel kick-back or loose steering. | 1. Excess lash in steering linkage.<br>2. Excessive lash between sector shaft and ball nut. | |

## SERVICE INFORMATION

### COMPONENT SPECIFICATIONS

STEERING COLUMN

Manufacturer: Saginaw.

STEERING GEAR

Manufacturer: Saginaw.

Type:
Recirculating ball bearing, worm and nut.
Ratio, 20 to 1
Pitman arm travel:
Left turn, 45-1/2°
Right turn, 45-1/2°

### LUBRICANTS AND CAPACITIES

LUBRICANT

The steering gear housing should be kept full of lubricant. Lubricate through side cover upper bolt hole.

Lubricants falling under one or more of the following specifications are recommended:

IH 135H EP, MIL-L-2105B, A. P. I. Classification: GL-5.

CAPACITIES

Steering gear housing - 1 quart

### SPECIAL TORQUES

| | |
|---|---|
| Column-to-flange nuts | 15-20 ft. lbs. |
| Flange bolt | 25-35 ft. lbs. |
| Lash adjuster lock nut | 18-27 ft. lbs. |
| Lash adjuster assembly cover cap screws | 25-40 ft. lbs. |
| Pitman arm nut | 100-125 ft. lbs. |
| Worm bearing adjuster lock nut | 70-100 ft. lbs. |

### ADJUSTMENTS

The following adjustments must be made with drag link disconnected from pitman arm and flange removed from worm shaft.

Loosen lock nut (2, Fig. 8-17) and turn lash adjuster screw (1) all the way in (clockwise),

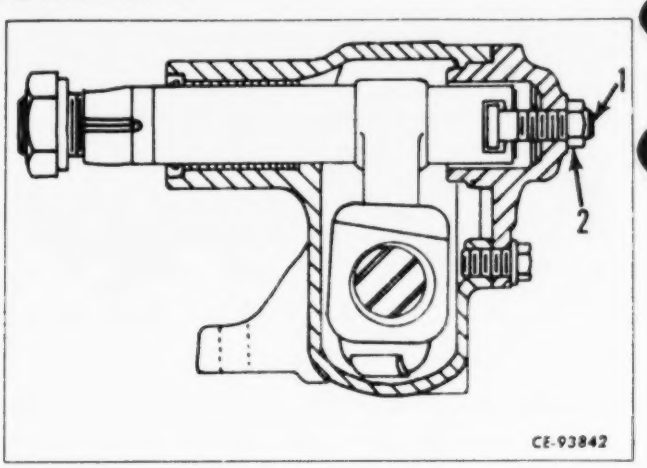


Figure 8-17

then out (counterclockwise) three turns. This will remove load imposed on worm bearings by close meshing of rack and sector teeth.

Using a socket on steering gear worm shaft, turn shaft from one stop all the way to the other carefully counting total number of turns.

NOTE: Do not turn hard against stops when drag link is disconnected as damage to ball guides may result.

Turn the shaft back one-half total number of turns to center position and using an inch-pound torque wrench, measure pull required to keep worm shaft in motion through center position. This should be 1-1/2 - 5-1/2 inch pounds.

If indicated pull does not lie between given limits, make the following adjustments:

a. Loosen lock nut (2, Fig. 8-18).

b. Turn adjuster (1) until required resistance to pull is reached.

c. Tighten lock nut and recheck pull. It must lie between limits specified after lock nut is tightened.

d. Turn lash adjuster screw (1, Fig. 8-17) clockwise to remove lash from gear teeth and tighten lock nut (2).

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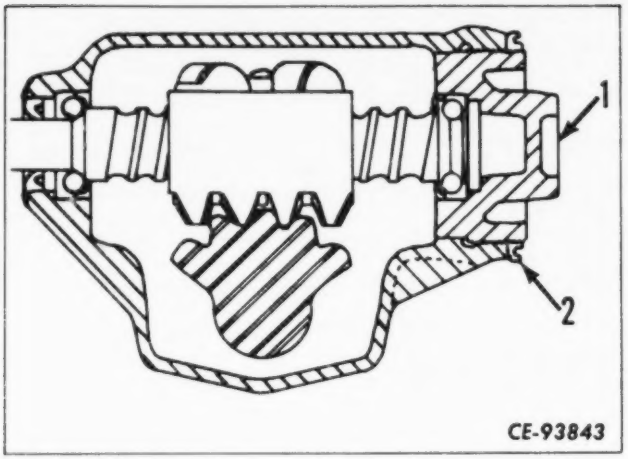


Figure 8-18

e. Check pull with socket and inch-pound torque wrench as before, taking highest reading of scale as shaft is turned through center position. This should be 3-7 inch-pounds over bearing adjustment but not to exceed a total of 11 inch-pounds.

f. Readjust lash adjuster screw if necessary to obtain proper pull.

g. Tighten lock nut and recheck pull. It must lie between specified limits after nut is tightened.

Reconnect drag link to pitman arm.

Install flange on gear and connect column to flange. Torque nuts. Refer to "SPECIAL TORQUES."

Torque: _____

# STEERING GEAR

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
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# SECTION IX
# LINKAGE

SECTION IX LINKAGE


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## TRANSMISSION CONTROL LINKAGE

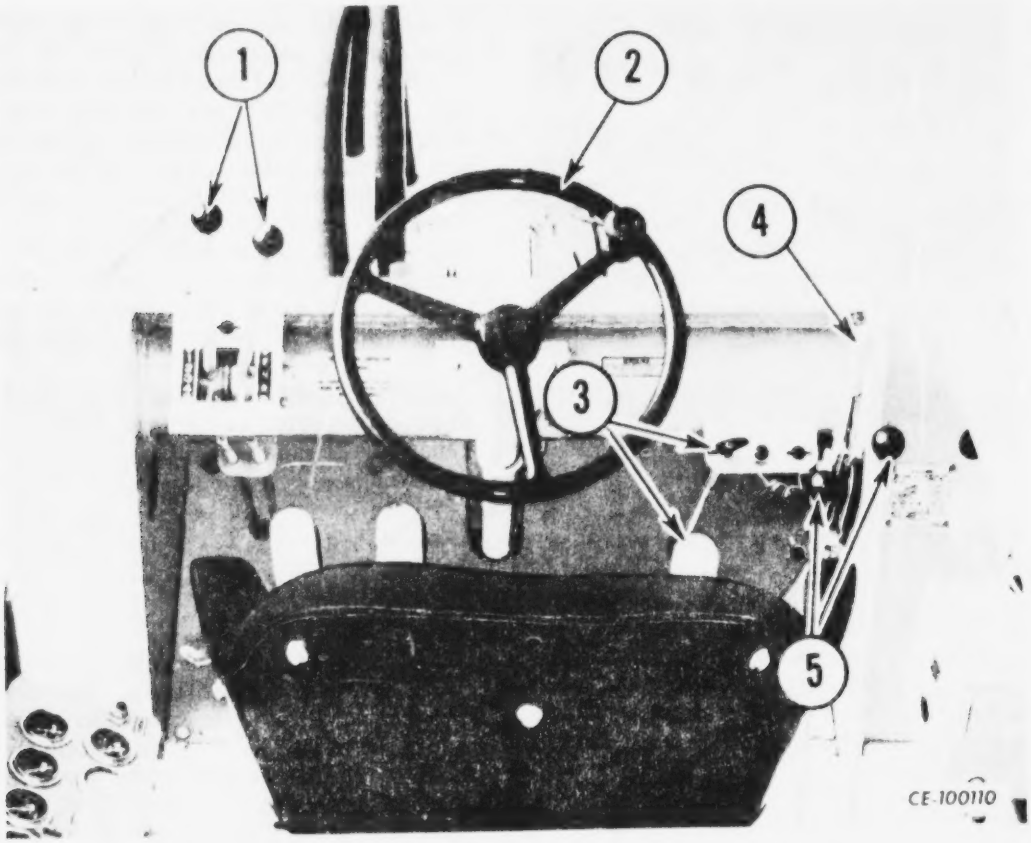


Figure 9-1
Tractor Control Linkage.

1. Transmission control linkage.
2. Steering linkage.
3. Accelerator linkage.
4. Parking brake linkage.
5. Hydraulic control linkage.

## REMOVAL

Remove cotter pins and clevis pins (6, Fig. 9-3) from control cable clevises (5) and detach from bellcrank arms of levers (1, 2). Remove clevises and lock nuts (7, 8) from cables and pull cables through mounting support and floorboard. Remove cotter pin and clevis pin from cable clevis (2, Fig. 9-2) at transmission directional bellcrank (6). Remove clevis and lock nut (3) from cable. Remove cable lock nut under bracket and pull cable through mounting bracket.

Disconnect range cable ball joint (9, Fig. 9-3) from transmission range bellcrank (10). Remove ball joint and lock nuts from cable and and pull cable through support bracket. Remove cables.

Disassemble control levers (1, 2, Fig. 9-3) by removing self-locking nut and cap screw from end of pivot pin (4). Use a soft drift pin to drive pivot pin from its supports. Discard "O" rings (3) as levers are removed.

To remove transmission directional bellcrank (6, Fig. 9-2) remove cotter and clevis pin (4) from links and valve spool.

Remove cotter pin and washer (5) from end of bellcrank support (1) and slide bellcrank and attached links from support. Discard bellcrank "O" rings (14, Fig. 9-3).

# LINKAGE

## TRANSMISSION CONTROL LINKAGE

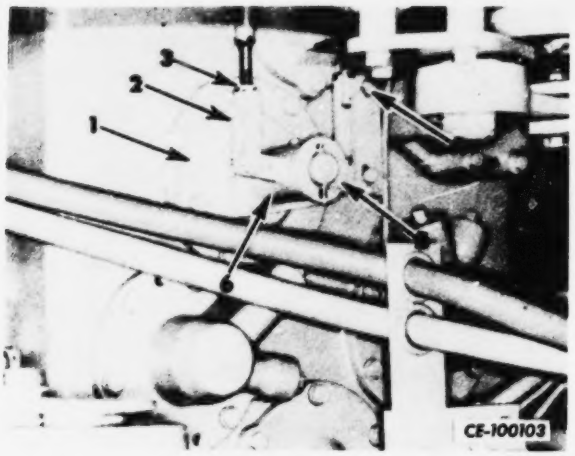


Figure 9-2

### INSPECTION

Examine cables for signs of deterioration, unbraiding and excessive wear. Check cable ends, clevises and ball joint. See that bores of clevises, bellcrank arms and connecting links are not excessively worn. Replace any parts that are doubtful.

### ASSEMBLY

Hand pack bushings of both levers (1, 2, Fig. 9-3) and transmission-mounted bellcrank (17) with chassis grease (NLGI-Grade 2) prior to assembly. Mount control levers (1, 2) by starting pivot pin (4) through support bracket. Slide a new "O" ring on pivot pin, then range control lever (2), another new "O" ring, directional lever (1) and a new "O" ring. Line up bore in end of pivot pin with bore in mounting. Install cap screw through mounting and pin bores and secure with new self-locking nut.

Thread cables up through floorboard and support bracket. Thread cable lock nuts (8) onto cables and tighten against support bracket. Thread cable clevis lock nuts (7) and clevises (5) onto cable ends. Attach clevises to lever bellcrank arms with clevis pins (6) and new cotter pins.

If previously removed, slip a new "O" ring (14) onto shaft of bellcrank support (13, Fig. 9-3) (1, Fig. 9-2), followed by the bellcrank (6, Fig. 9-2), another new "O" ring and secure to mounting (1) with flat washer (5) and new cotter pin. Connect links to valve spool and bellcrank arm with clevis pins (4) and new cotter pins. Thread cable ends through their support brackets and secure to brackets with cable lock nuts. Thread clevis lock nut (3) and clevis (2) onto cable end and attach clevis to bellcrank arm with clevis pin and new cotter pin.

Assemble lock nut and ball joint (9, Fig. 9-3) to range selector cable end. Attach ball joint to arm of bellcrank lever (10) with nut and lock washer.

### ADJUSTMENT

Disconnect both control cables from their bellcrank arms on transmission. Position directional control lever in "NEUTRAL" and range control lever in "1. " Block or otherwise immobilize both levers in these positions until adjustments are completed. Position range bellcrank lever (10, Fig. 9-3) in its uppermost position. Adjust cable ball joint (9) so it freely fits bore of lever arm and secure it with nut and lock washer.

Position directional bellcrank (17) in its center position. Adjust clevis (11) so that clevis bore aligns with bore of bellcrank arm. Install clevis pin (12) and secure with new cotter pin.

Remove lever blocking and start engine. Operate tractor throughout full range of speeds in both forward and reverse. Check for positive action of levers and correct positioning of transmission spools.

When adjustments are satisfactorily completed, shut off engine, tighten all lock nuts and bend over cotter pins.

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## TRANSMISSION CONTROL LINKAGE

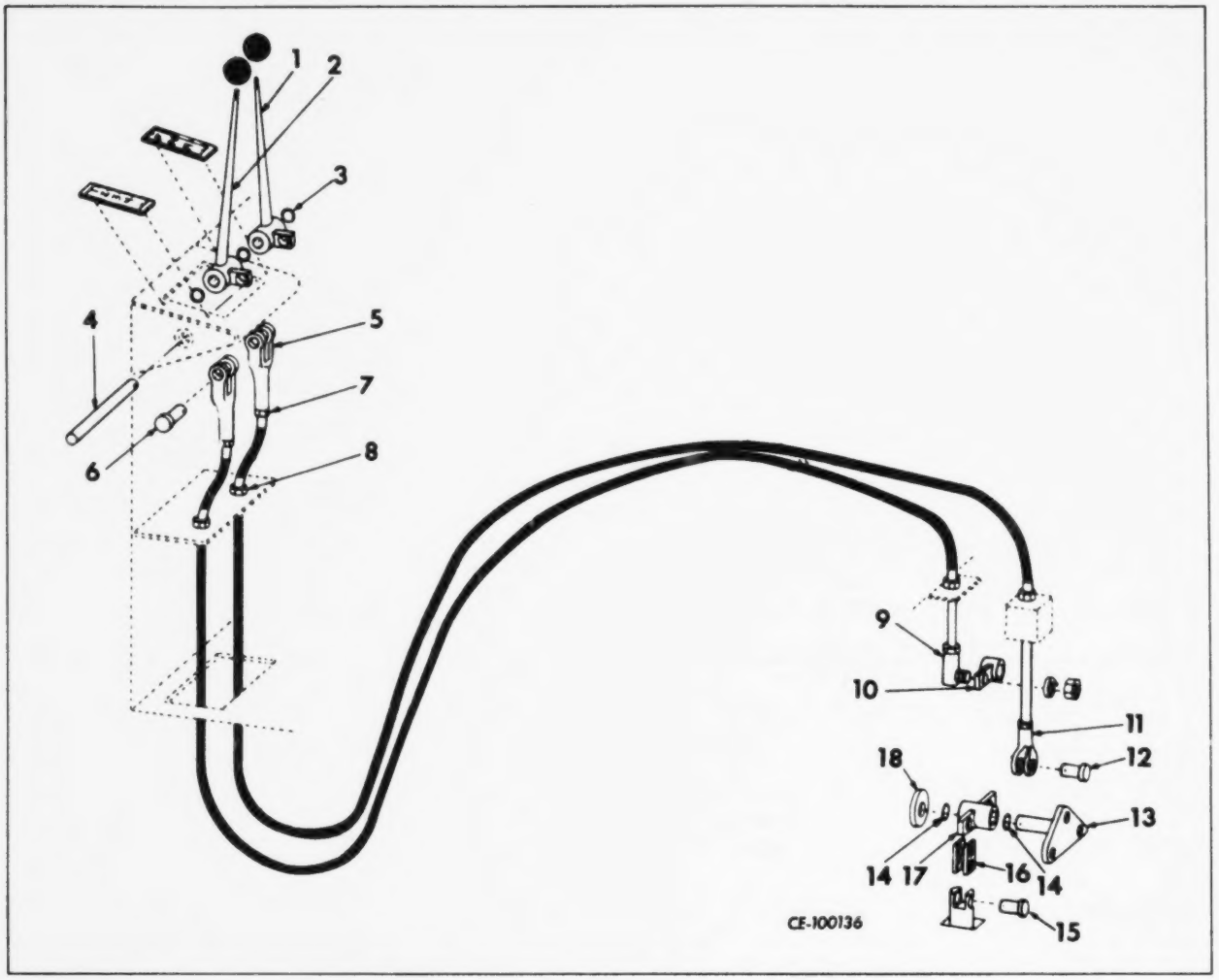


Figure 9-3
Transmission Control Linkage.

1. Directional lever.
2. Range lever.
3. "O" ring.
4. Lever pivot pin.
5. Clevis.
6. Clevis pin.
7. Clevis lock nut.
8. Cable lock nut.
9. Ball joint.
10. Range bellcrank lever.
11. Clevis.
12. Clevis pin.
13. Bellcrank mounting bracket.
14. "O" ring.
15. Clevis pin.
16. Bellcrank links.
17. Directional bellcrank.
18. Washer.

# LINKAGE

## STEERING LINKAGE

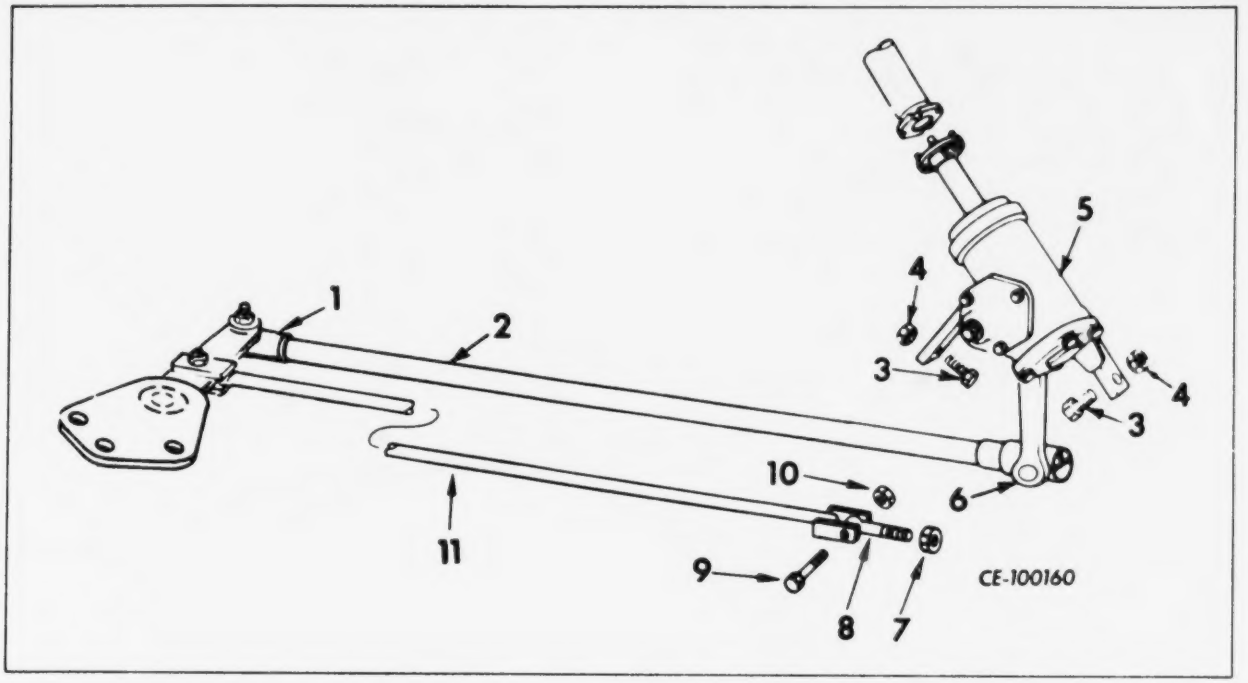


Figure 9-4
Steering Linkage.

1. Drag link end.
2. Drag link.
3. Stop bolt.
4. Lock nut.
5. Steering gear.
6. Pitman arm.
7. Lock nut.
8. Rod end.
9. Cap screw.
10. Nut.
11. Steering rod.

### REMOVAL

Position tractor in straight ahead position and install frame locking safety bar. Disconnect ball studs from pitman arm (6, Fig. 9-4) and pivot lever arm (3, Fig. 9-6). Remove drag link (2, Fig. 9-4) with assembled drag link ends (1) and ball studs.

Disassemble drag link ends by removing cotter pin (4, Fig. 9-5) and adjusting plug (11). Remove ball stud (9). Do not lose ball seats (8, 10).

Remove ball seats (8, 10), spring (7), safety plug (6) and seat (5). To remove drag link end, loosen clamp cap screw and nut (2) and remove drag link end from threaded end of rod by turning in a counterclockwise direction.

Disconnect steering rod end (6, Fig. 9-6) from lever arm by removing self-locking nut from pivot bolt (5). Remove lever arm pivot (3) and bearing by removing lock nut (4) and flat washer. Dismount pivot lever mounting bracket (1) by removing mounting hardware (2).

Remove large cover plate on right side of front frame.

Steering valve end of steering rod is removed by removing nut and cap screw (1, Fig. 9-7) from rod end. Remove steering rod from machine.

If removal of pitman arm (6, Fig. 9-4) is necessary, punch mark pitman arm and sector shaft for assembly reference. Remove arm retaining nut and using a suitable puller, remove arm from sector shaft.

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## STEERING LINKAGE

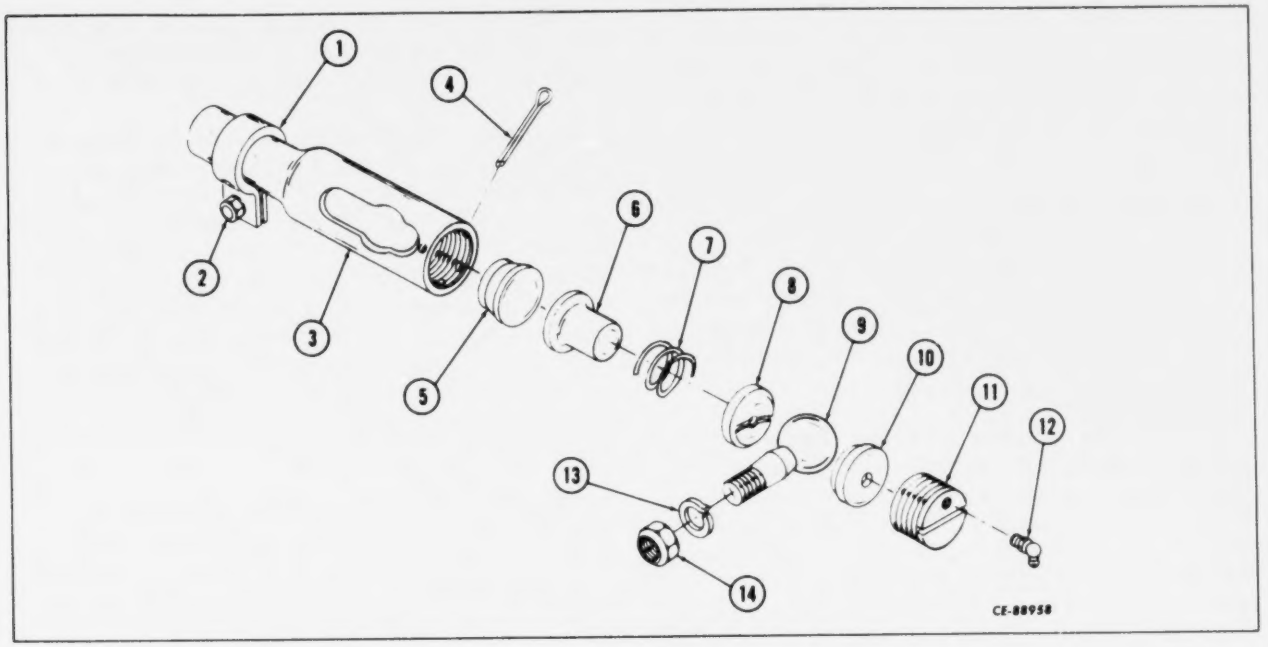


Figure 9-5
Drag Link End.

1. Clamp.
2. Cap screw and hex nut.
3. Drag link end.
4. Cotter pin.
5. Seat.
6. Safety plug.
7. Spring.
8. Ball seat.
9. Ball stud.
10. Ball seat.
11. Adjustment plug.
12. Grease fitting.
13. Lock washer.
14. Hex nut.

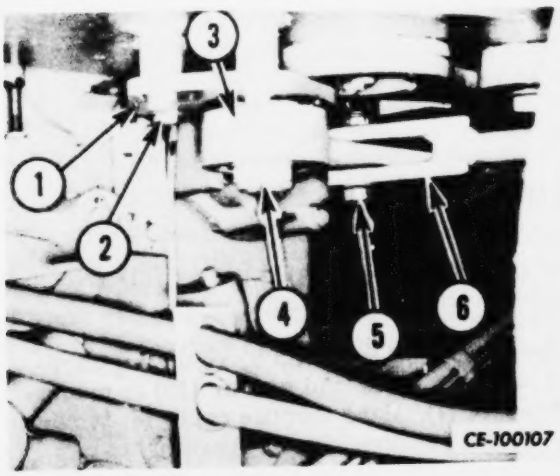


Figure 9-6

1. Pivot lever mounting bracket.
2. Bracket mounting hardware.
3. Lever arm pivot.
4. Lock nut.
5. Pivot bolt.
6. Steering rod end.

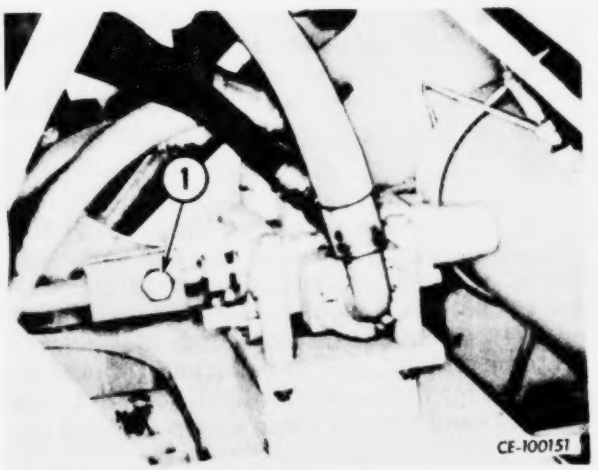


Figure 9-7

## STEERING LINKAGE

### INSPECTION

Examine all components for signs of deterioration and wear. Check condition of lever arm pivot bearing. Replace bearing if worn or damaged.

### ASSEMBLY AND ADJUSTMENT

Install pivot lever mounting bracket (1, Fig. 9-6) with mounting cap screws and lock washers (2). Assemble lever arm (3) to mounting bracket and install flat washer and new self-locking nut (4).

If pitman arm has been removed, install arm on sector shaft, matching previously made punch marks. If new gear or pitman arm are used, center steering gear before installing pitman arm. Center steering gear by turning steering wheel gently as far as it will go in one direction. Turn steering wheel in opposite direction gently, counting number of turns until wheel stops. Turn wheel back one-half total number of turns. Gear is now centered. Install pitman arm straight down, 90° to floor, on steering gear.

Position lever arm 90° to center line of tractor. Attach rod end (8, Fig. 9-4) to steering valve with cap screw (1, Fig. 9-7) and nut. With lock nut (7, Fig. 9-4) loosened, turn rod (11) in or out of steering valve until bore of steering rod end (6, Fig. 9-6) matches bore in lever arm. Install pivot bolt (5) through rod end. Use a new self-locking nut on pivot bolt and tighten securely. Tighten lock nut (7, Fig. 9-4).

Thread drag link ends (3, Fig. 9-5) onto rod. Do not tighten clamps (1). Insert seats (5), safety plug (6), spring (7), ball seat (8), ball stud (9), ball seat (10) and end plug (11). Apply grease to ball seats (8, 10) before assembly. Tighten plug (11) until no free play exists between ball seats and ball stud WITHOUT compressing spring (7). Tighten plug an additional half turn to compress spring. If plug slot and cotter pin holes in end do not match, tighten plug until cotter pin can be inserted. Bend over cotter pin.

Install ball studs of assembled drag link to pitman arm and lever arm without disturbing their pre-set positions. Turn drag link ends to provide proper fit. Tighten clamp bolts when drag link is satisfactorily installed.

Turn machine to right so frame closes. Lock frame halves together with frame locking safety pin. Shut down engine and adjust pitman arm stop bolt (3, Fig. 9-4) so it is snug against pitman arm. Lock stop bolt securely with lock nut (4). Remove frame locking safety pin, turn tractor to left, install frame locking pin and adjust remaining pitman arm stop bolt so it is snug against pitman arm. Lock stop bolt securely with lock nut. Remove frame locking pin.

## ACCELERATOR LINKAGE

### REMOVAL

Remove nut and lock washer securing accelerator rod ball joint (2, Fig. 9-8) to accelerator pedal (1). From under floorboard, disconnect ball joint (6) from arm of bellcrank (14) and remove rod (4) with assembled ball joints. Loosen screw of hand throttle cable clamp (12) and remove clamp. Loosen fitting screw (11) and withdraw cable from fitting.

Lever (9) may be removed by removing hardware securing lever and spacer (10) to mounting bracket (7). Hand throttle cable (8) is removed from its mounting in operator's compartment by removing mounting lock nut from beneath bracket and pulling cable out through bracket.

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## ACCELERATOR LINKAGE

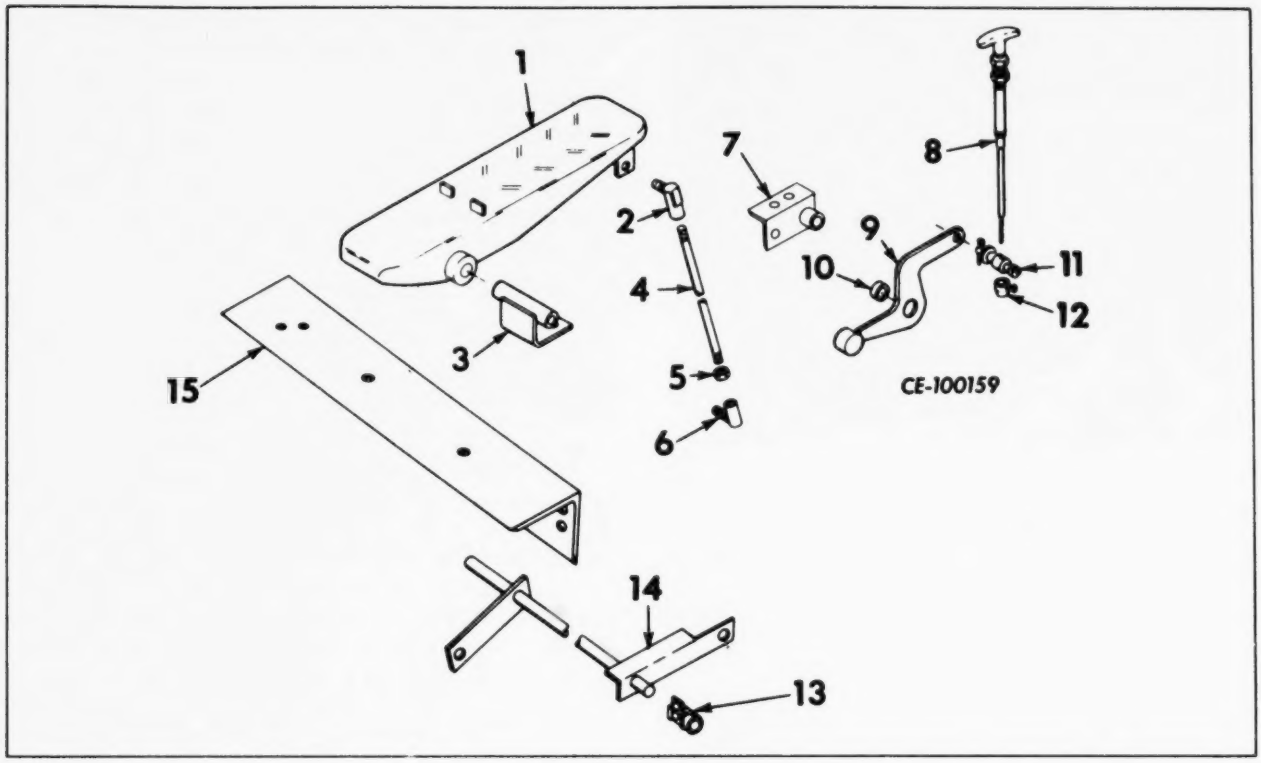


Figure 9-8
Hand and Foot Throttle Linkage.

1. Accelerator foot pedal.
2. Ball joint.
3. Hinge.
4. Accelerator rod.
5. Lock nut.
6. Ball joint.
7. Lever mounting bracket.
8. Hand throttle cable.
9. Lever.
10. Spacer.
11. Cable fitting.
12. Cable clamp.
13. Bearing.
14. Bellcrank.
15. Bellcrank mounting bracket.

Disconnect accelerator cable ball joint (1, Fig. 9-9) from bellcrank arm (3) by removing nut and lock washer (2). Remove ball joint and lock nut from end of cable. Remove cable nut securing cable to bracket (5) and pull cable through bracket.

If bellcrank requires removal, remove hardware securing bearings (4) to mounting bracket and remove bearings and bellcrank.

At engine end of cable, disconnect spring (2, Fig. 9-10) from spring clips (1, 3). Loosen lock nut (6) and slide it down cable. Loosen cable lock nut at threaded connector (7) and unscrew cable from connector. On Cummins engines, disconnect cable ball joint from injector lever. Remove spring clips and lock nut and pull cable through cable bracket (4).

## ACCELERATOR LINKAGE

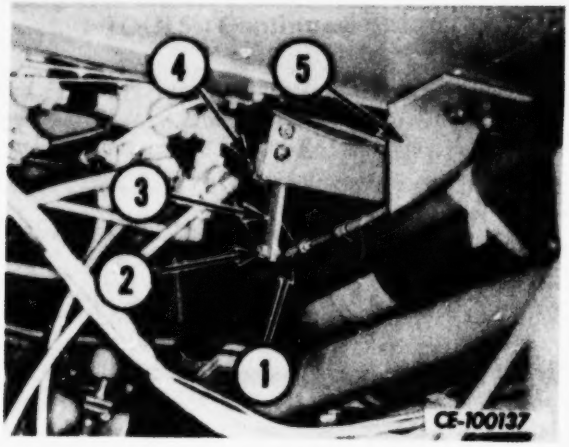


Figure 9-9
Accelerator Linkage

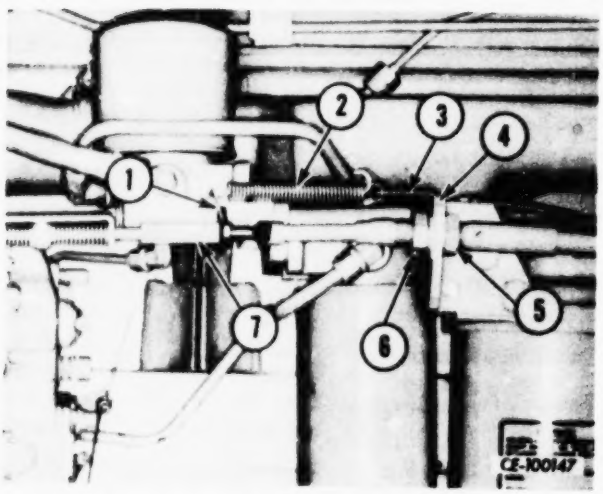


Figure 9-10

### INSPECTION

Examine all components for signs of wear, damage or impending failure. Check all welds, bushings and bearings. Replace any parts not suitable for further service.

Operate hand throttle and accelerator cables to check smoothness of operation. If either cable binds or operation is not smooth, replace it.

### ASSEMBLY AND ADJUSTMENT

Insert hand throttle (8, Fig. 9-8) through mounting bracket and secure to bracket with lock nut. If lever (9) and spacer (10) were removed, assemble them to lever mounting bracket (7) with appropriate hardware.

Mount bellcrank (14) with bearings (13) on bracket (15). Be sure end of lever (9) is above arm of bellcrank. Attach ball joint (6) of accelerator rod (4) to arm of bellcrank (14) with nut and lock washer. Position bellcrank arm (14) parallel to floor.

Feed accelerator cable through bracket (5, Fig. 9-9) and secure to bracket with lock nut. Thread lock nut and ball joint (1) onto cable end. Attach ball joint to bellcrank arm (3) and secure with lock washer and nut (2).

Feed end of cable through bracket (4, Fig. 9-10). Assemble spring clip (3) and lock nut (6) on cable end. Thread lock nut onto cable end. Slip spring clip (1) onto cable end and thread cable into connector (7). Position clip properly and tighten nut. Position other spring clip (3) and tighten cable lock nut. Connect spring (2) to spring clips. Check to be sure bellcrank arm (14, Fig. 9-8) is still in horizontal position, parallel to floor. If not, adjust cable connections and/or mountings to achieve the horizontal position.

With cable and bellcrank arm properly adjusted, connect ball joint (2) to accelerator pedal (1). Start engine and check low idle speed. Refer to "SERVICE INFORMATION" in Section II, "ENGINE." Depress pedal fully. Be sure that injection pump lever has travelled its full stroke. Check engine high idle speed. If further adjustments are required to obtain correct engine speeds, shut down engine first.

When foot throttle linkage is satisfactorily adjusted, pass end of hand throttle cable (8, Fig. 9-8) through cable fitting (11), with handle of cable pushed all the way down. Allow a very slight clearance between lever (9) and bellcrank arm (14). Securely tighten screw of cable fitting (11). Slip cable clamp (12) onto end of cable. Hold it snugly against cable fitting and tighten securely. Tighten all lock nuts. Correctly adjusted, the hand throttle allows the fuel injection pump lever to travel to the low idle position with the throttle pushed in; with the throttle pulled all the way out the engine must maintain a minimum speed of 1200 rpm (no load).

The throttle should lock in position by turning the handle one quarter turn.



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## PARKING BRAKE LINKAGE

### REMOVAL

Remove cotter pin and clevis pin from control cable clevis and brake actuating arm. Remove clevis and lock nut from cable end. Remove cable lock nut (1, Fig. 9-11) and pull cable through support bracket (2).

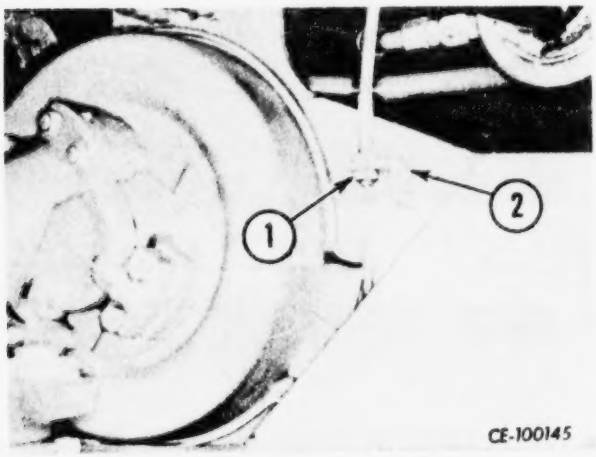


Figure 9-11

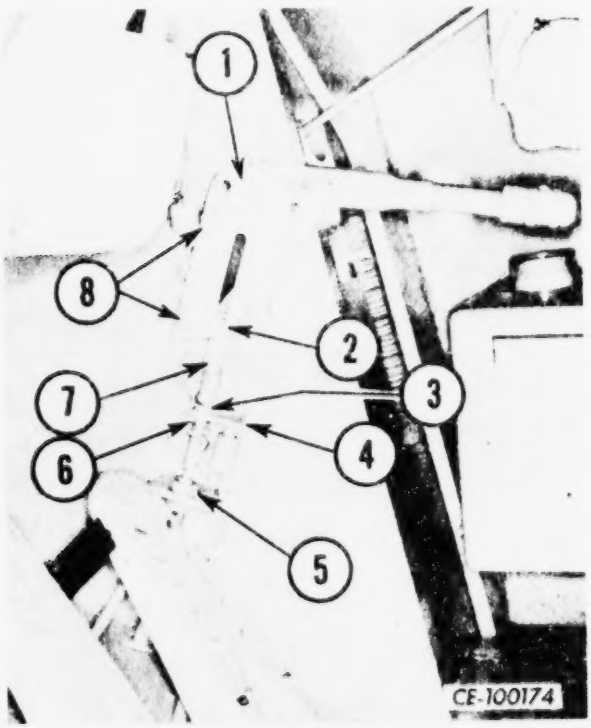


Figure 9-12

Dismount parking brake assembly (1, Fig. 9-12) from sidewall of operator's compartment by removing hardware (8) securing brake assembly to mounting bosses. Remove cotter pin, flat washer and pin (2) from brake assembly and cable clevis (7). Separate cable and clevis from brake assembly. Remove clevis, lock nut (3), switch actuating plate (4) and lock nut (6) from cable. Remove cable lock nut (5) at support bracket and pull cable through bracket and floorboard.

### INSPECTION

Carefully examine all system components for signs of deterioration and/or excessive wear. Operate cable to determine its freedom of movement. Replace any defective parts.

### ASSEMBLY

Thread cable up through floorboard and mounting bracket on sidewall in operator's compartment.

Thread cable lock nut (5, Fig. 9-12) onto cable. Assemble lock nut (6), switch plate (4), clevis lock nut (3) and clevis (7) to cable end. Attach clevis to brake assembly with pin (2), flat washer and cotter pin. Install spacers in brake assembly and mount to bosses with mounting hardware (8).

Position switch actuating plate (4) properly and tighten clevis lock nut and actuating plate lock nut. If previously removed, thread cable lock nut onto other end of cable and pass cable end through support bracket (2, Fig. 9-11) at brake drum. Thread lock nut (1) onto cable. Thread clevis lock nut and clevis onto cable end. Attach clevis to brake actuating arm with clevis pin and new cotter pin.

### ADJUSTMENT

Turn adjustable top of brake handle counterclockwise as far as possible. Disconnect cable clevis from brake actuating arm. Loosen clevis lock nut and adjust clevis until bores of clevis and actuating arm are aligned, with actuating arm slack taken up. If necessary, loosen cable lock nuts at cable support brackets and adjust cable to allow proper alignment of clevis and brake actuating arm. Tighten all lock nuts after adjustment is completed. Be sure system is adjusted so that brake is pulled up tight when handle is activated and warning light switch is closed by switch actuating plate.

# LINKAGE

## HYDRAULIC CONTROL LINKAGE

### REMOVAL

Remove large cover plate from right side of front frame to gain access to hydraulic control bellcranks (6, Fig. 9-13) and their connections.

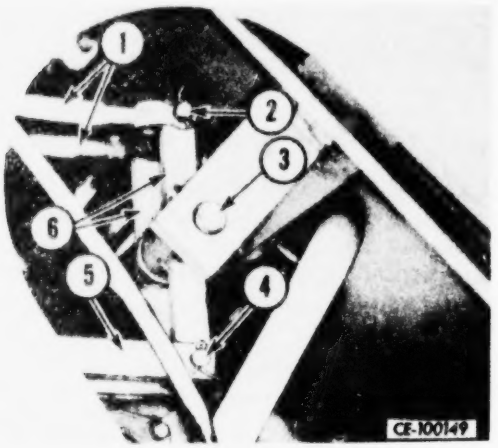


Figure 9-13

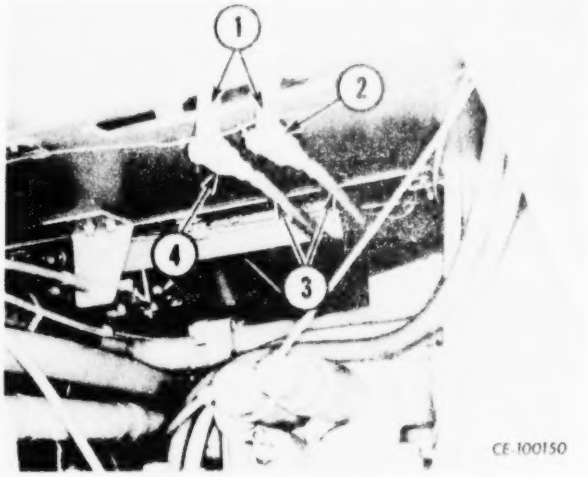


Figure 9-14

Disconnect control rods (1, Fig. 9-13) (3, Fig. 9-14) from control levers (1, Fig. 9-14) and bellcranks (6, Fig. 9-13) by removing cotter pins and clevis pins (2, Figs. 9-13 and 9-14).

Remove both sets of link bars (5, Fig. 9-13) from bellcranks (6) and valve spools by removing cotter pins and clevis pins (4) from both ends.

Disassemble control levers (1, Fig. 9-15) from their mounting bracket (2) in operator's compartment by removing pivot pin retaining cap screw from bracket arm and driving pivot pin (3) out through brackets with a soft drift pin. Discard used "O" rings. Disassemble bellcrank assemblies (6, Fig. 9-13) in a similar manner.

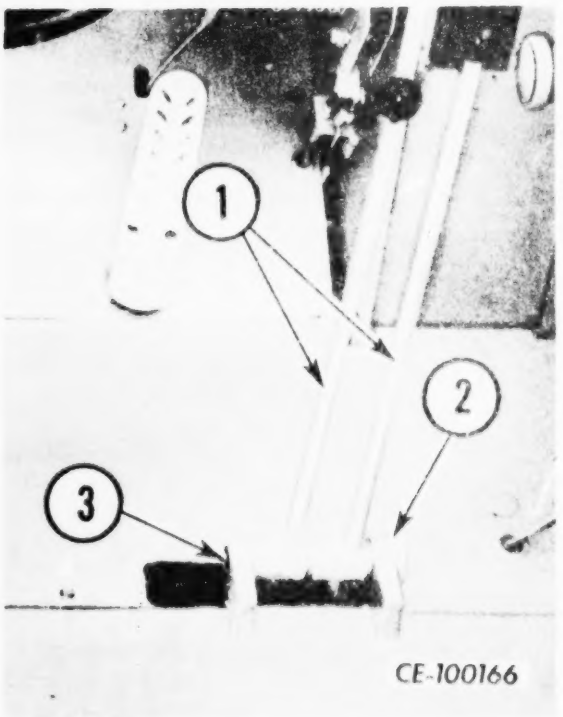


Figure 9-15

## HYDRAULIC CONTROL LINKAGE

### INSPECTION

Carefully inspect all components for signs of excessive wear, cracked or broken welds or bent rods. Hubs of control levers and bellcranks are equipped with Teflon bushings. If bushings are worn or damaged they must be replaced. To replace bushings, remove hub plugs and press out old bushings. Press in new bushings flush with outside edge of hub. Replace any components deemed unfit for further service.

### ASSEMBLY AND ADJUSTMENT

Hand pack hubs of control levers and bellcranks with chassis grease. If previously removed, install and tighten hub plugs.

> NOTE: DO NOT replace hub plugs with grease fittings. Pressure lubrication may cause serious damage to Teflon bushings.

Assemble bellcranks (6, Fig. 9-13) and control levers (1, Fig. 9-15) to their mounting brackets by inserting pivot pins (3) through bracket arms bored for pin retaining cap screws with drilled end of pivot pins entering last. As pivot pins are pushed through, install a new "O" ring, bellcrank or control lever, another new "O" ring, the next bellcrank or control lever and then a final new "O" ring. Align bores of mounting bracket arms and pivot pins and install and tighten retaining cap screws.

Attach link bars (5, Fig. 9-13) to bellcrank arms and valve spools with clevis pins (4) and new cotter pins. Position both valve spools in their center positions.

If previously removed, assemble lock nuts and clevises (4, Fig. 9-14) to threaded ends of control rods (1). Attach welded clevis ends of control rods to bellcrank arms with clevis pins (2, Fig. 9-13). Be sure that control lever end of rods have the bend angling down from clevis. With both control levers in vertical position and valve spools in their center positions, adjust clevises (4, Fig. 9-14) so their bores align with bores of lever arms. Install clevis pins (2) and cotter pins. Hold clevises in a horizontal position while tightening lock nuts. This will keep clevis from turning during tightening and imposing a frictional bind.

Start engine and after warm-up operate hydraulic control levers throughout several cycles to check for proper adjustment. If all adjustments are satisfactory, shut down engine and lower boom and bucket to ground. Replace access panel.

# LINKAGE

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

# SECTION X
# HYDRAULIC LINES AND FITTINGS

(This Section Included in Section XI)

# SECTION XI
# HYDRAULIC SYSTEM

Page

SECTION XI HYDRAULIC SYSTEM


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## GENERAL INFORMATION

### DESCRIPTION

This section has been prepared for convenient reference to information on the H-100C Hydraulic System, its maintenance and repair.

### PREVENTIVE MAINTENANCE

Cleanliness, the correct type of oil and sufficient oil supply for the system are the most important maintenance requirements.

a. The correct viscosity oil should be used according to ambient temperature. Oil added to the system should be of the same type and viscosity.

b. Proper oil storage will eliminate the possibility of contamination. Improper storage and handling of oil will encourage failures. It is easier to keep foreign material out of the oil before it is used than it is to remove it once it is in the hydraulic system.

c. Oil level in the reservoir should be kept to "H" mark on dipstick at all times.

d. Reservoir oil and filter should be changed at regular intervals, to be determined by type of operation, ambient temperature and work conditions.

e. System pressures should be checked at regular intervals - at least once per month and at the first suspicion of a system problem.

Fittings, "O" rings, hoses and cap screws should be checked often.

a. All connections should be checked for leaks and "O" rings replaced if damaged. All cap screws kept tightened.

b. Reservoir dipstick should be kept tightened at all times. No other means of covering opening or different type dipstick should be used.

c. Covers on valve adjusting screws should be tightened and "O" rings checked to prevent dirt from entering.

### REQUIRED TOOLS

Standard Mechanics Hand Tool Set

Hose - 3500 PSI minimum working pressure rating.

Gauge - 5000 PSI minimum working pressure rating.

Connectors - Sufficient to attach gauge and hose to following pressure ports:

1/8" NPT steering pressure port
1/4" NPT hydraulic pressure port

Torque wrench - 0-500 ft. lbs. rating

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### HYDRAULIC RESERVOIR

#### GENERAL

All components of the hydraulic reservoir may be serviced or removed without removing the reservoir from the tractor.

Perform the following operations before disassembling the reservoir for replacement and servicing of internal parts.

a. Start the engine and operate the hydraulic control levers several times until the system oil becomes warm. Stop the engine.

b. Loosen the reservoir filler cap gradually to bleed off reservoir pressure before removing the filler cap.

c. Place a container under the reservoir drain. The container used should be large enough to catch the volume of oil in the reservoir. Remove the drain plug and direct the flow of draining oil through a large funnel and a length of hose fitted over the funnel spout.

#### REMOVAL

Remove all hydraulic lines from reservoir. Cap and tag each line to prevent entry of dirt and provide identification for proper assembly. Cover all open ports. Remove hardware securing reservoir to tractor frame and remove reservoir from tractor.

#### DISASSEMBLY

Remove cover retainer segments (3, Fig. 11-1) by removing retainer cap screws (4) and nuts (22). Remove cover (21) and "O" ring (5) from reservoir body (15).

Remove and discard self-locking nuts (6) holding filter retainer plate (7) in place. Remove plate.

Remove filter elements (8) and spacers (9) and place filters on a clean surface.

Remove strainer screens (10) by loosening and removing clamps (11).

NOTE: Early models have only one strainer screen.

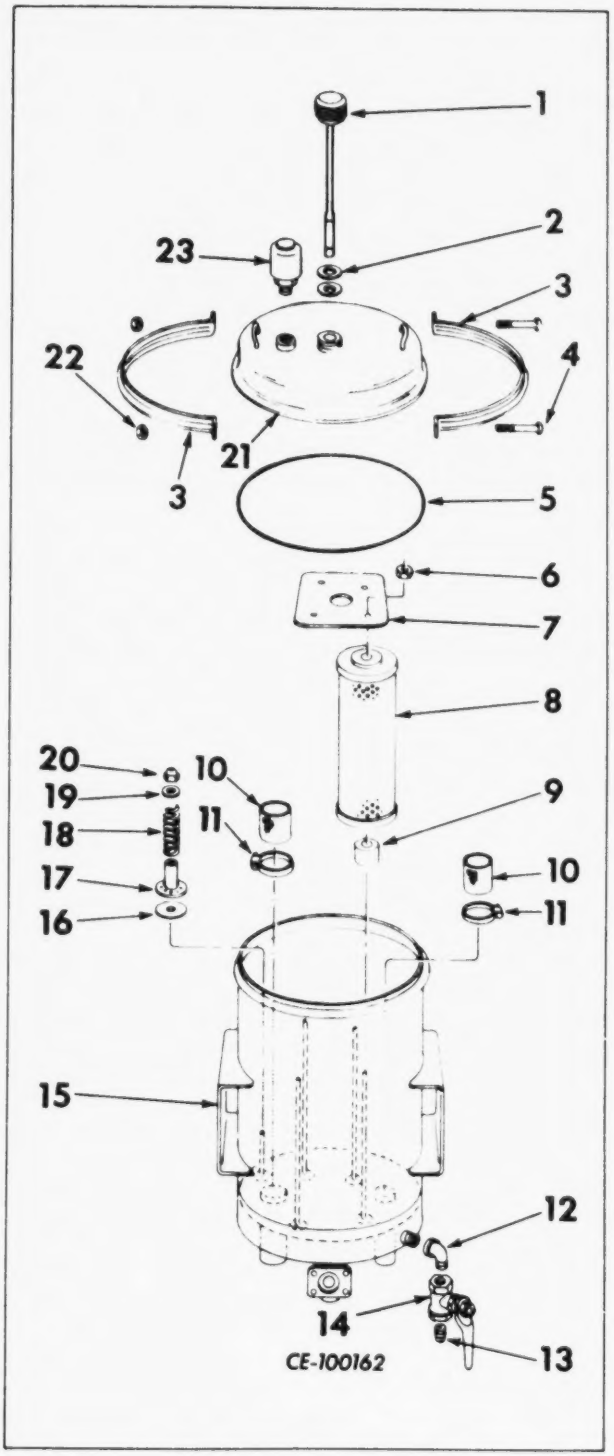


Figure 11-1
Typical Hydraulic Reservoir.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Legend for Figure 11-1

1. Dipstick.
2. Dipstick seals.
3. Retainer.
4. Cap screw.
5. "O" ring.
6. Nut.
7. Retainer plate.
8. Filter element.
9. Spacer.
10. Screen.
11. Clamp.
12. Elbow.
13. Pipe plug.
14. Drain valve.
15. Reservoir.
16. Insulator.
17. Valve.
18. Spring.
19. Washer.
20. Acorn nut.
21. Cover.
22. Nut.
23. Relief valve.

Remove acorn nut (20), washer (19), spring (18), valve (17) and insulator (16) from guide in bottom of reservoir.

### INSPECTION

Check parts for wear or deterioration and replace if necessary. Clean exterior of reservoir with a spray of clean solvent. Rinse inside of reservoir with a warm flushing solution made of four parts of clean diesel fuel oil to one part of clean lubricating oil. Dry reservoir with filtered compressed air and cover large opening.

NOTE: Do not use steam or caustic soda to clean reservoir or any internal parts.

Before assembling reservoir, examine drained oil for harmful deposits.

Examine used filter elements to determine condition of hydraulic system components.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

### ASSEMBLY

Check reservoir interior for cleanliness. Install strainer screens (10, Fig. 11-1) in bottom of reservoir and secure them with clamps (11).

Install valve insulator (16) on valve guide. Install in order, valve (17), spring (18), flat washer (19) and cap nut (20). When cap nut is securely tightened, spring will automatically be compressed to proper setting.

Install spacers (9) and new filter elements (8) over hold-down rods, being certain they are properly seated. Place filter retainer plate (7) over filters and secure with new self-locking nuts (6). Tighten nuts to recommended torque. (Refer to "SPECIAL TORQUES.")

Torque: _____

Position new seal ring (5) around large reservoir opening. Position cover (21) on reservoir so it fits snugly on seal.

Secure cover with cover retainer (3) segments, cap screws (4) and nuts (22). Tighten cover cap screws and nuts to recommended torque (Refer to "SPECIAL TORQUES").

Torque: _____

Be sure that reservoir drain valve is closed and drain plug (13, Fig. 11-1) is in place.

### INSTALLATION

If reservoir has been removed from tractor, remount complete reservoir assembly. Connect all lines to reservoir, using new "O" rings. Be sure all lines, pump and reservoir ports are clean and free of obstructions before connecting.

Add oil to the reservoir through the dipstick opening in the reservoir. Refer to "LUBRICANTS AND CAPACITIES" for type oil to use according to expected work and ambient temperature conditions.

Fill reservoir, filter oil through a fine-mesh screen.

Fill reservoir to full mark on dipstick. Start and run engine to reduced speed while operating controls to circulate oil throughout various circuits and to purge air from system. Check reservoir oil level frequently, adding oil as necessary to full mark on dipstick. Stop engine and lower bucket to ground. Re-check oil level.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### RELIEF VALVE

Disassemble valve (Fig. 11-2) in numerical order.

Clean and inspect parts.

Replace parts: 5, 9, 13, 14.

Assemble in reverse order. Apply Loctite Grade "E" to threads of Item No. 15.

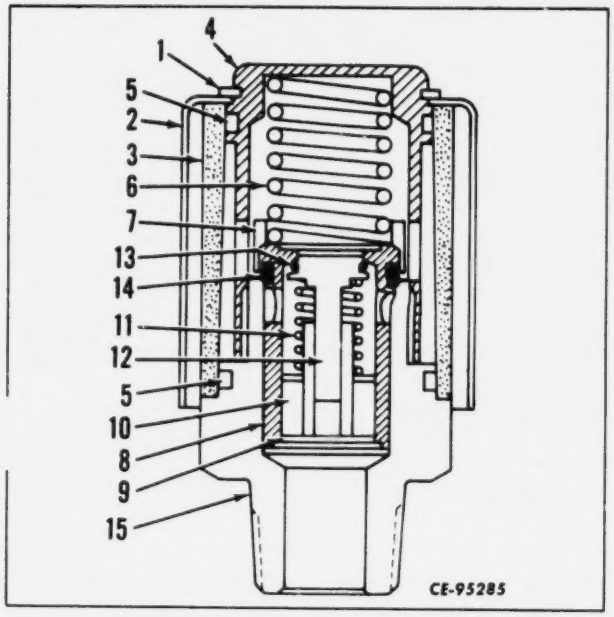


Figure 11-2
Relief Valve.

1. Lock ring.
2. Cover.
3. Filter.
4. Cap.
5. Filter seal (2).
6. Spring.
7. Retainer.
8. Sleeve.
9. Lock ring (2).
10. Guide.
11. Poppet spring.
12. Poppet.
13. Poppet seal.
14. Sleeve seal.
15. Body.

### DRAIN VALVE

Disassemble valve (Fig. 11-3) in numerical order.

Clean and inspect parts.

Replace parts: 6, 7, 9.

Assemble in reverse order.

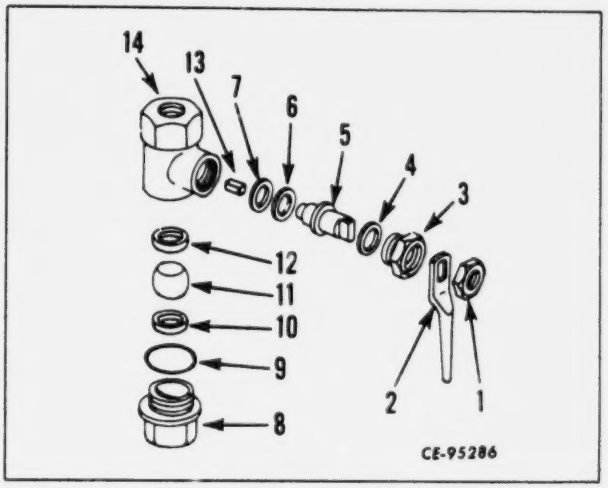


Figure 11-3
Drain Valve.

1. Lock nut.
2. Handle.
3. Bushing nut.
4. Thrust washer.
5. Stem.
6. Back-up ring.
7. Stem seal.
8. End cap.
9. Body seal.
10. Seat.
11. Ball.
12. Seat.
13. Stop pin.
14. Body.

### HYDRAULIC PUMPS

#### GENERAL

Do not remove or disassemble either pump unless it is known to be in need of repairs. First, eliminate all other possibilities of hydraulic system malfunction as outlined in the "TROUBLE SHOOTING" section of this manual.

Before disassembly, have the correct pump gasket set on hand. Pump disassembly will probably damage "O" rings, back-up rings and seals. Pump assembly without replacing these parts is not practical.

NOTE: For correct repair parts, refer to current "PARTS MANUAL."

The following instructions describe the disassembly, inspection and assembly of a typical pump. A variation in parts configuration may be found between pumps of different application on any given machine; however, the basic design remains the same.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

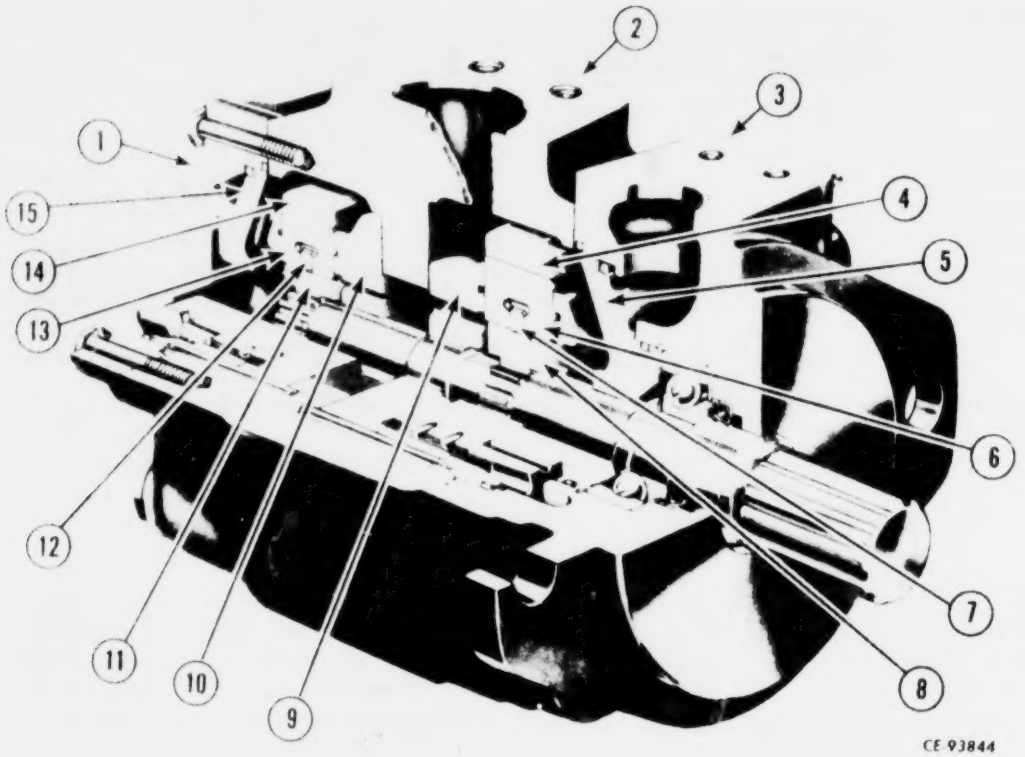



Figure 11-4
Typical Hydraulic Pump.

1. Outlet cover.
2. Inlet housing.
3. Outlet body.
4. Ring.
5. Pressure plate.
6. Vane.
7. Intra-vane.
8. Rotor.
9. Wear plate.
10. Wear plate.
11. Rotor.
12. Intra-vane.
13. Vane.
14. Ring.
15. Pressure plate.

### REMOVAL

a. Drain oil from reservoir. Remove pump lines and cap to prevent entry of dirt. Identify each line to insure proper installation when pump is replaced on tractor.

b. Remove cap screws holding pump to converter. Remove pump carefully, being sure that splined shaft is not damaged. Cap pump ports and clean exterior of pump before disassembly.

c. Disassemble pump on a clean work bench to prevent entry of dirt and/or foreign material.

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### HYDRAULIC PUMPS - Continued

DISASSEMBLY

Scribe marks (5, Fig. 11-5) on pump housing to aid in positioning parts during assembly.

Remove cap screws (4) that secure cover inlet housing (1). Remove cover.

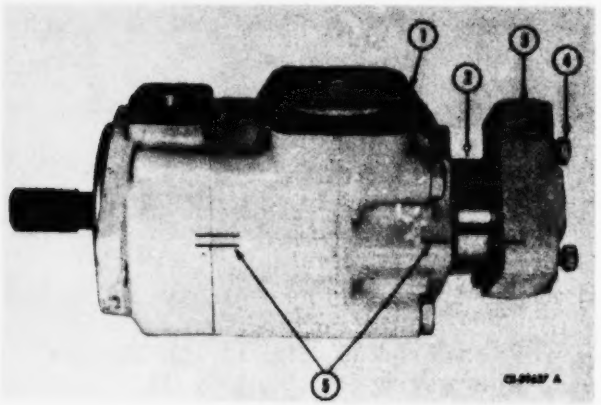
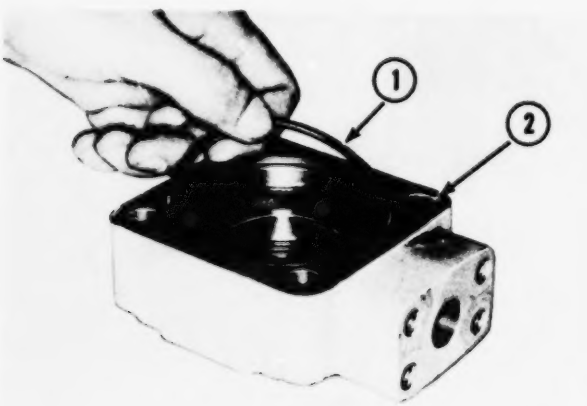


Figure 11-5

Remove "O" ring (1, Fig. 11-6) from cover (2).



CE-89628

Figure 11-6

Before removing cartridge from housing note direction of rotation and GPM rating (Fig. 11-7). It is essential that cartridge be reassembled correctly. Remove cartridge (2, Fig. 11-5) from inlet housing (1).

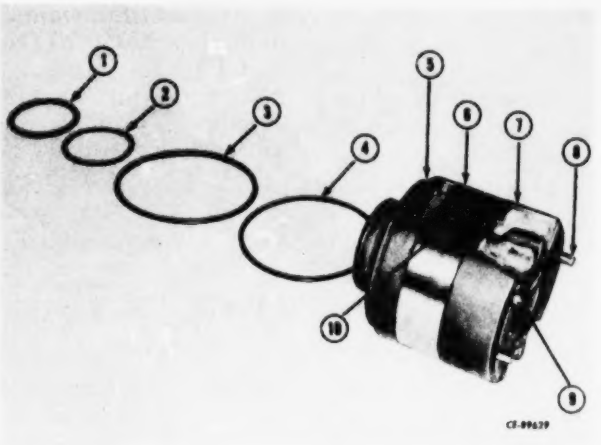


Figure 11-7

NOTE: The direction of rotation is viewed from the shaft end; right hand rotation is clockwise; left hand, counterclockwise.

Remove "O" rings and back-up rings (1, 2, 3 and 4, Fig. 11-7) from cartridge.

Remove screws (9) from cartridge. Note capacity and direction of rotation (10) stamped on ring (6) of cartridge.

Remove wear plate (7). Remove rotor, being careful that vanes stay in position. Remove cam ring (6) and locating pins (8).

NOTE: If it is necessary to remove vanes from rotor, be sure during assembly that highest edge of bevel (1, Fig. 11-8) is facing the direction of rotation.

Remove cap screws (5, Fig. 11-9). Remove housing (4), cartridge (3) and "O" ring (2) and back-up ring from body (1).

Remove "O" rings and back-up rings (1, 2, 3 and 4, Fig. 11-7) from cartridge.

Remove screws (8) from cartridge. Note capacity and direction of rotation (10) stamped on ring (6) of cartridge.

Remove wear plate (6, Fig. 11-10). Remove rotor (3) being careful that vanes (4) stay in position. Remove cam ring (2). Remove locating pins (1) by sliding them out of pressure plate (5).

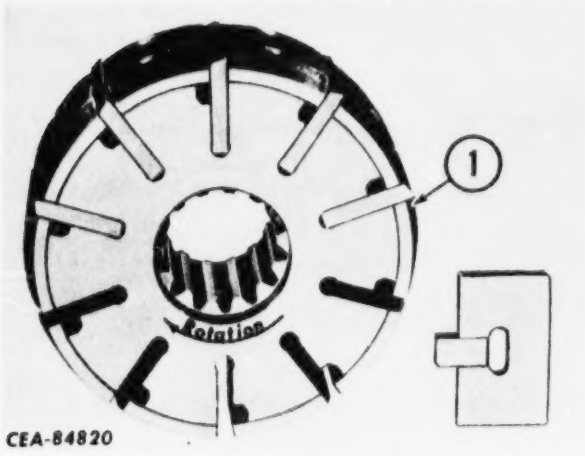



Figure 11-8

NOTE: If it is necessary to remove vanes from the rotor, be sure during assembly that highest edge of bevel (1, Fig. 11-8) is facing the direction of rotation.

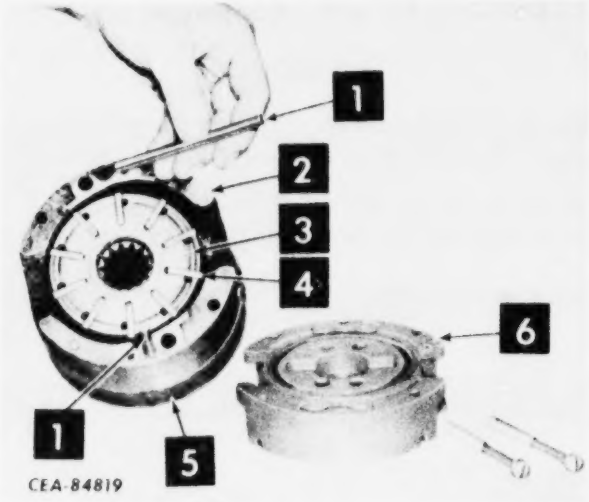



Figure 11-10

Remove snap ring (3, Fig. 11-11). Remove shaft with bearing (2) from body (1).

(Continued on next page)

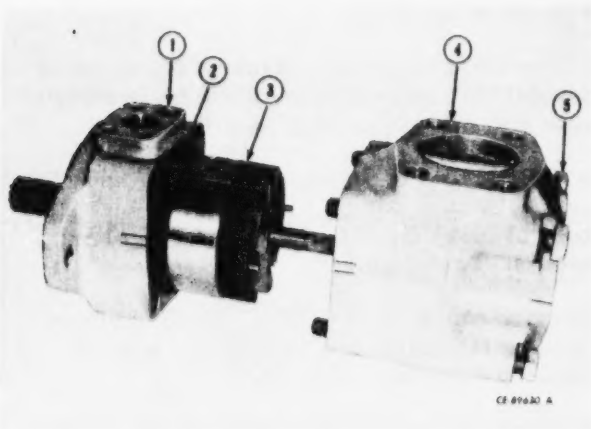



Figure 11-9

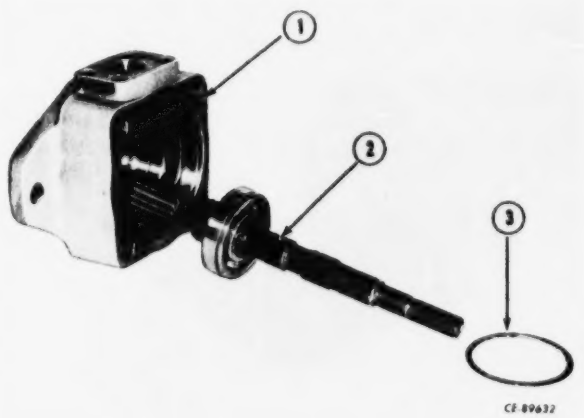



Figure 11-11

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### HYDRAULIC PUMPS - Continued

DISASSEMBLY - Continued

Remove washer (4, Fig. 11-12) seal (3) and wiper (2) from body (1).

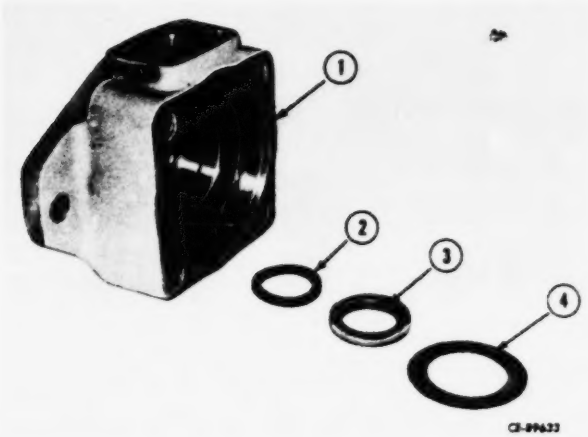



Figure 11-12

Using snap ring pliers (1, Fig. 11-13) remove snap ring (2).

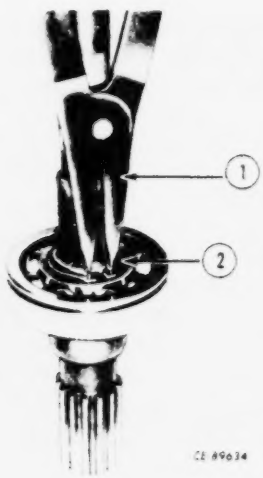



Figure 11-13

Press bearing (1, Fig. 11-14) from shaft in an arbor press, supporting the inner race.

NOTE: Current bearings (1, Fig. 11-14) do not use snap ring and groove on outer bearing race O.D.

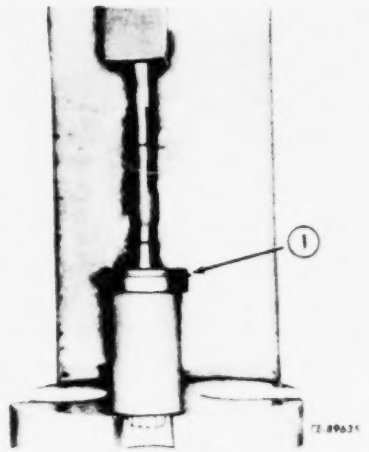



Figure 11-14

INSPECTION

Discard shaft seal and all "O" rings and back-up rings. Use a new gasket kit for assembly. Wash metal parts in clean mineral solvent, dry with filtered compressed air and place them on a clean surface for inspection.

Check pumping cartridges for signs of wear. Inspect cam rings for scoring and corresponding marks on vanes. All vanes should slide freely in rotor slots without sticking or side play. Vanes should drop in rotor slots by their own weight when both slots and vanes are dry. Check slots and rotor shaft for wear.

Do not repair or "touch-up" any of the parts contained in the pump cartridges. These parts are machined to close tolerances which can easily be destroyed. Replacement of complete cartridge assemblies is recommended if worn rings or vanes are found.

Check pressure plate faces for scoring marks. Lap out score marks if possible or replace the plates.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

### ASSEMBLY

NOTE: Coat all parts with clean hydraulic fluid to facilitate assembly and provide initial lubrication. Use small amounts of petroleum jelly to hold the "O" rings in place during assembly.

NOTE: Direction of rotation is viewed from shaft end; right hand rotation is clockwise; left hand, counterclockwise.

Install a new felt wiper and a new oil seal. Using the proper seal installation tool (refer to "SPECIAL TOOLS" under "SERVICE INFORMATION"), press the seal into position (Fig. 11-15).

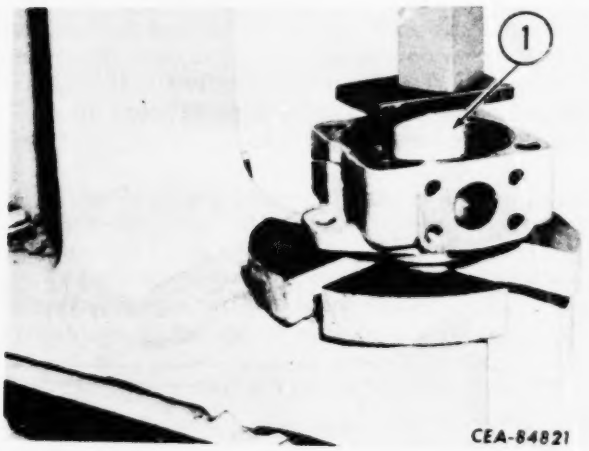


Figure 11-15

Press shaft into bearing (1, Fig. 11-16) in an arbor press, supporting the inner race.

Using snap ring pliers (1, Fig. 11-13), install snap ring (2) on shaft.

Install washer (4, Fig. 11-12) in body (1).

Install shaft with bearing (2, Fig. 11-11) in body (1) and secure with ring (3).

Place rotor (3, Fig. 11-10) on pressure plate (5), with arrow on rotor pointed in correct direction of rotation (10). Place inserts in vanes (4) and install assembly in rotor slots. Be sure

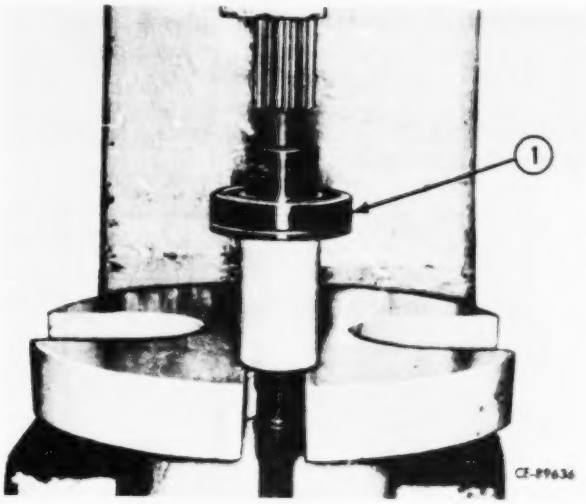


Figure 11-16

sharp edges are toward the direction of rotation (Fig. 11-8).

Install locating pins (1, Fig. 11-10) in pressure plate (5) and place ring (2) over them with ring arrow pointing in correct direction of rotation. Apply a small amount of grade CV-4-10 "Loctite" to screw threads. Install wear plate (6) and screws. Be certain to tighten screws securely.

Install new "O" rings and back-up rings (1, 2, 3 and 4, Fig. 11-7) after lubricating them with petroleum jelly.

Install a new back-up ring and "O" ring (2, Fig. 11-9) after lubricating them with petroleum jelly. Install cartridge (3) in body (1) (using a twisting motion). Be certain pins engage in the body. Install housing (4) and secure with cap screws (5). Torque cap screws. Refer to "SPECIAL TORQUES."

Torque: _____

Assemble remaining cartridge (2, Fig. 11-5) as described above.

Install a new "O" ring (1, Fig. 11-6) in the cover (2).

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### HYDRAULIC PUMPS - Continued

#### ASSEMBLY - Continued

Install cartridge (2, Fig. 11-5) and cover (3). Secure with cap screws (4). Torque cap screws. Refer to "SPECIAL TORQUES."

Torque: _____

Service and overhaul procedures for the single element steering circuit pump used on late models is basically the same as described for the dual element pump. Note the cover bolt torque recommendations in "SPECIAL TORQUES."

Steering Pump Torque: _____

#### INSTALLATION

Carefully align pump splined shaft with splined drive on torque converter. Slide pump in and secure to converter with cap screws. Connect previously tagged lines to their proper ports. Use new "O" rings at all split flange connections. Be sure all flange cap screws are tight.

### MAIN CONTROL VALVE

#### REMOVAL

Remove the valve as follows:

a. Disconnect the control valve linkage from the valve.

b. Remove, cap and tag the connecting lines.

c. Remove the cap screws, washers and nuts that secure the valve to the frame.

#### DISASSEMBLY

Disassemble valve on a clean work bench. Plug or cap valve ports and openings to prevent entry of dirt. Note orientation of components as they are removed and disassembled.

Remove poppet plugs (1, Fig. 11-17) (5, Fig. 11-18) (3, Fig. 11-19) spring (2) and poppet (1). Remove and discard seal rings and back-up ring from poppet and seal ring from plug.

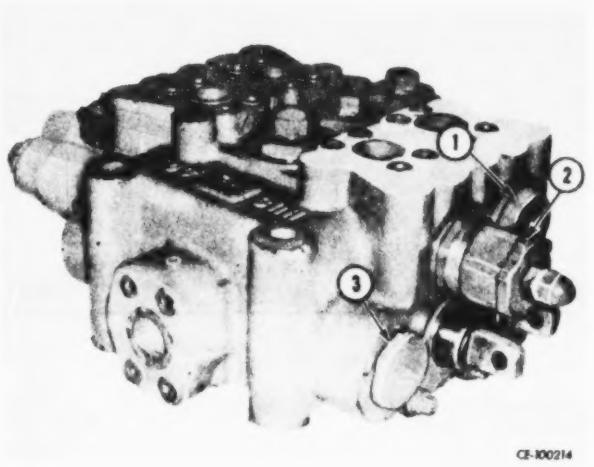


Figure 11-17
Main Control Valve - Spool End.

1. Poppet plug - (anti-void valve).
2. Boom cylinder relief valve.
3. Sleeve cap.

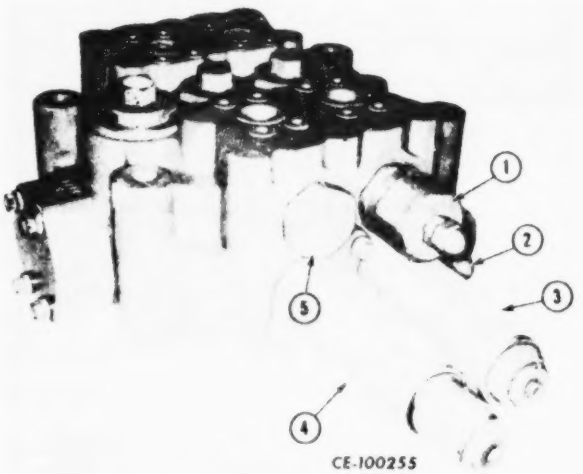


Figure 11-18
Main Control Valve - Plunger Cap End.

1. Bucket cylinder relief valve.
2. Main relief valve.
3. Plunger cap.
4. Plunger cap.
5. Poppet plug (anti-void valve).

## DISASSEMBLY, INSPECTION AND ASSEMBLY

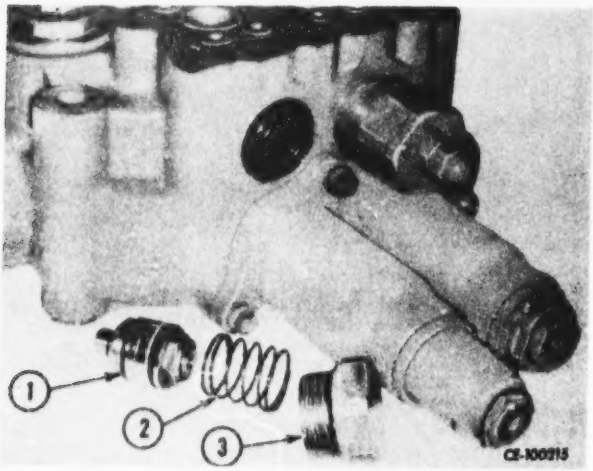


Figure 11-19

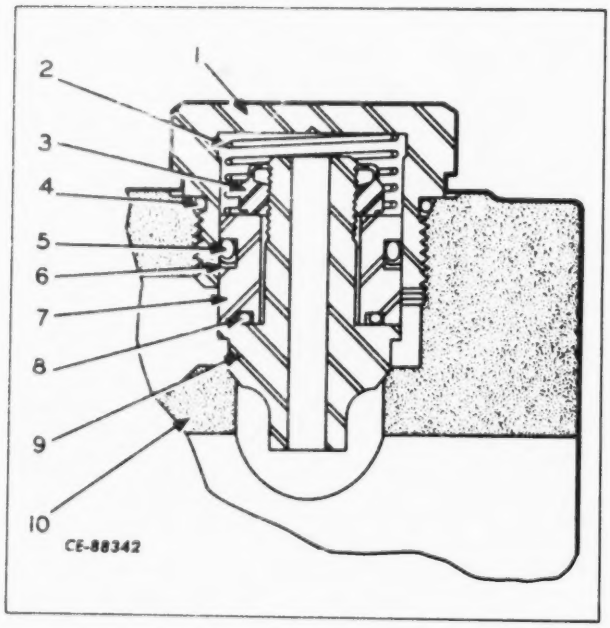


Figure 11-20
Anti-Void Valves.

1. Plug.
2. Spring.
3. Lock nut.
4. "O" ring.
5. "O" ring.
6. Back-up ring.
7. Poppet - upper portion.
8. "O" ring.
9. Poppet - lower portion.
10. Main control valve body.

Hold lower portion of poppet (9, Fig. 11-20) and remove lock nut (3). Remove and discard "O" ring (5-8) and back-up ring (6).

Remove plug (4, Fig. 11-21) from sleeve (1). Slide piston (2) and spacer (3) from sleeve. Spacer is found only in bucket plunger. (Spacer not used on machines equipped with bucket leveler); remove "O" rings (5) from plugs (4) and discard.

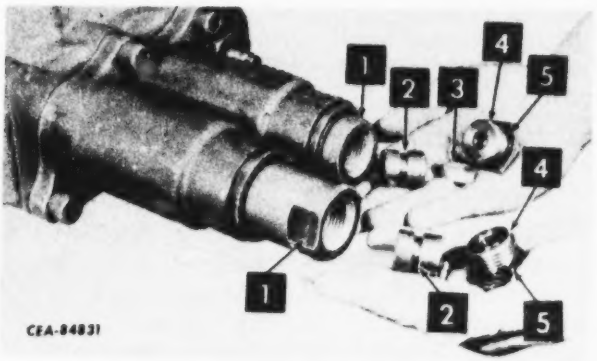


Figure 11-21

Remove Spir-O-Lox (2, Fig. 11-22) and spacer (1) from detent sleeve (3).

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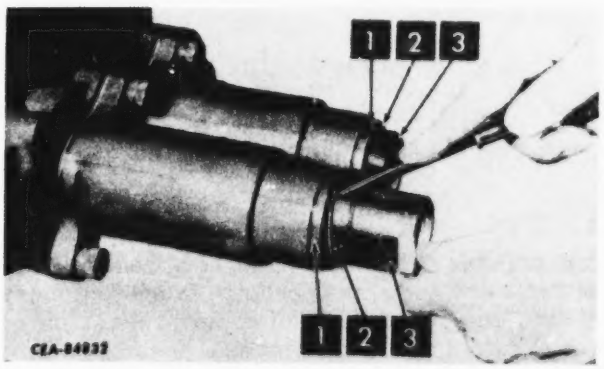


Figure 11-22

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### MAIN CONTROL VALVE - Continued

DISASSEMBLY - Continued

Remove cap screws (1, Fig. 11-23) that secure plunger cap (3) to valve body (2). Remove plunger cap.

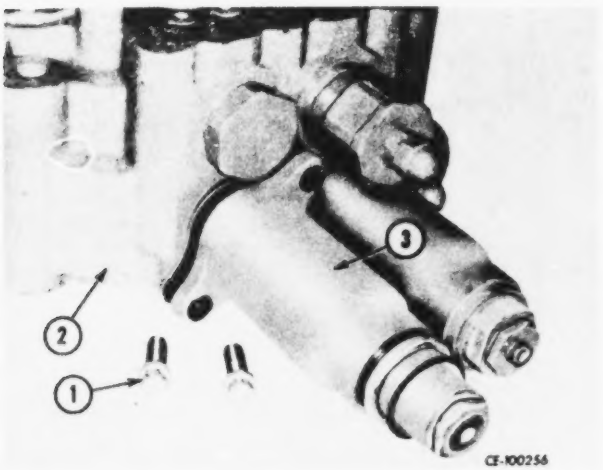


Figure 11-23

Remove scraper ring (3, Fig. 11-24), spacer ring (2) and "O" ring (1) from eye (4) end of plunger. Discard seal components.

Figure 11-24

Pull boom plunger assembly (2, Fig. 11-25) from valve body (1).

Figure 11-25

Slide detent sleeve (1, Fig. 11-26) from plunger (3) using a punch to depress detent cam. Use caution to prevent loss of detent balls (2).

Figure 11-26

After removing detent sleeve (1, Fig. 11-27) from plunger pin (2), slide spring (3), detent cam (5) and detent balls (4) from plunger assembly.

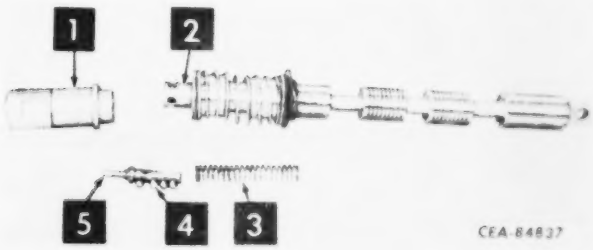


Figure 11-27

Place eye end of plunger in vise with protective jaws. Remove plunger pin (1, Fig. 11-28) from plunger assembly (2) using a rod of approximate diameter as holes in end of plunger. Use caution to prevent damage to holes.

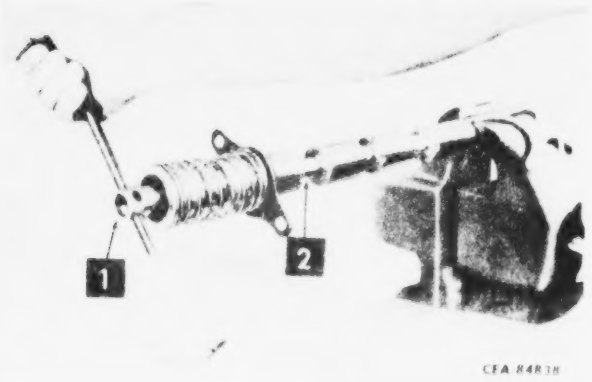


Figure 11-28

Remove plunger pin (1, Fig. 11-29) spring (2), spring seat (5) and seal plate (3) from plunger (4). Exert pressure against plunger pin as it disengages plunger and release spring tension slowly.

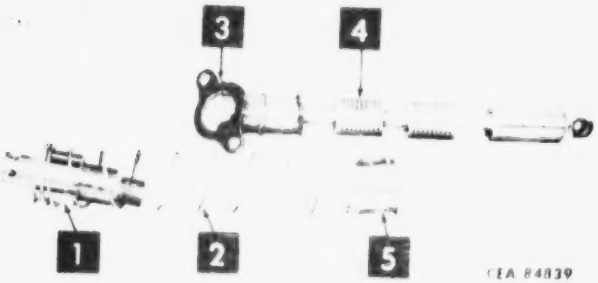


Figure 11-29

Repeat above procedure to remove bucket plunger.

Disassemble main relief valve (2, Fig. 11-18) as follows:

Loosen and remove acorn nut (17, Fig. 11-30) and washer (16). Remove jam nut (15), washer (14) and screw (13). Slide spring (12) and poppet (11) from plug (10). Remove plug (10). Remove and discard "O" rings (7 and 9) and back-up ring (8) from plug. Slide spring (6), piston (5) and poppet (2) from sleeve (1). Remove and discard "O" ring (4) and back-up ring (3) from poppet. Tap sleeve (1) from valve body.

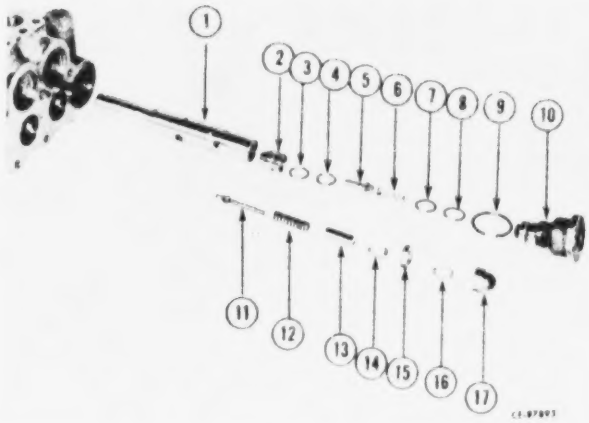


Figure 11-30

Disassemble cylinder relief valves (2, Fig. 11-17) (1, Fig. 11-18) as follows:

These are cartridge type valves and may be removed as a unit.

a. Loosen and remove valve housing (12, Fig. 11-31) from control valve body (20). Relief valve may be placed on a bench for further disassembly.

b. Remove plug (6) from housing (12). If desirable, plug assembly may be left intact. In this manner the valve setting will remain unchanged. For a thorough inspection however, valve must be completely disassembled.

c. Remove "O" rings (7-11) and back-up ring (10) from plug (6) and discard rings.

d. Remove acorn nut (1), jam nut (4) and copper washers (3-5) from adjusting screw (2).

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

### MAIN CONTROL VALVE - Continued

DISASSEMBLY - Continued

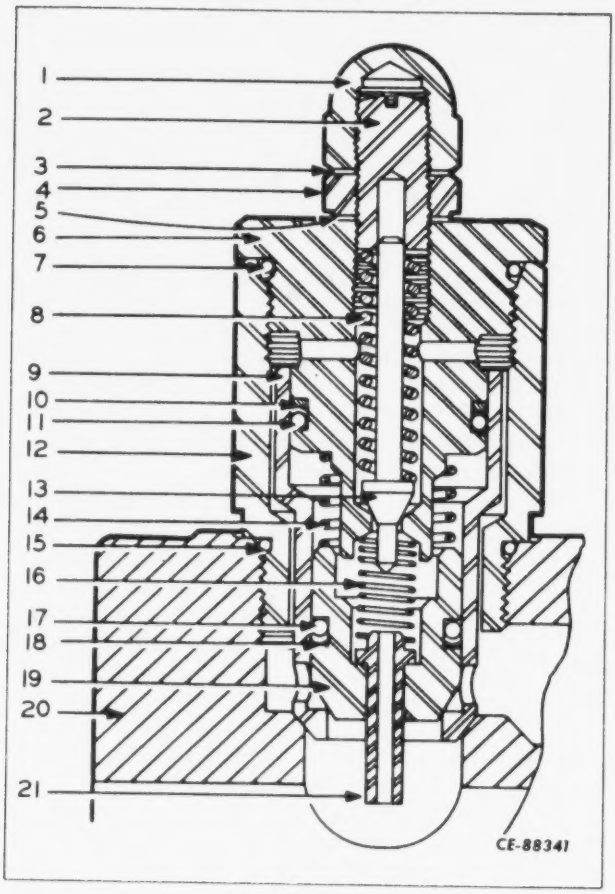



Figure 11-31
Cylinder Relief Valve.

1. Acorn nut.
2. Adjusting screw.
3. Copper washer.
4. Jam nut.
5. Copper washer.
6. Plug.
7. "O" ring.
8. Pilot poppet spring.
9. Check valve poppet.
10. Back-up ring.
11. "O" ring.
12. Housing.
13. Pilot poppet.
14. Poppet spring.
15. "O" ring.
16. Piston spring.
17. "O" ring.
18. Back-up ring.
19. Poppet.
20. Main control valve housing.
21. Piston.

e. Remove adjusting screw (2), spring (8) and pilot poppet (13) from plug bore.

f. Remove check valve poppet (9) from housing (12). Remove and discard "O" ring (15) from housing (12).

g. Remove springs (14-16) poppet (19) and piston (21) from check valve poppet (9). Remove and discard "O" ring (17) and back-up ring (18) from poppet (19).

To complete main valve disassembly, remove check valves (1, Fig. 11-32). Remove check valve plug (4), spring (3) and poppet (2) from valve body. Discard "O" rings (5).

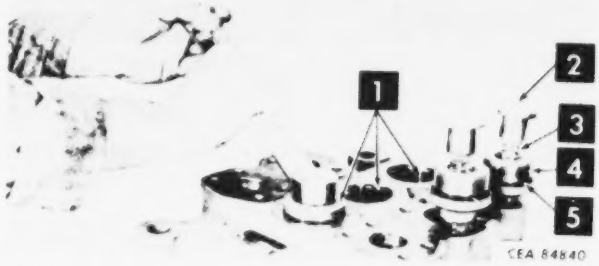



Figure 11-32

#### INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace valve assembly. Stone or use crocus cloth on small scores.

All parts with sliding fit must move freely in their bores. All grooves and passages must be free of foreign matter.

Replace springs if they are broken or distorted.

Replace detent balls that are worn or deformed.

Replace all "O" rings and back-up rings.

Check orifice (1, Fig. 11-33) in boom spool bore to be sure there are no obstructions.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

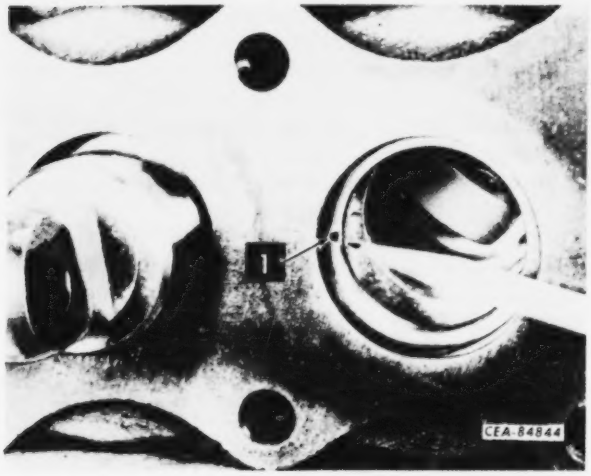



Figure 11-33

Listed below are instructions that must be followed to insure correct installation and effective sealing of "O" rings.

a. Seal counter bores must be thoroughly cleaned.

b. "O" rings, plungers, and counter bores must be lubricated on assembly.

c. "O" rings must be free of molding defects and handling damage.

d. "O" RINGS MUST NOT BE STRETCHED beyond the yield point. (Wrap a stiff paper around plunger to protect the "O" ring passing over the sharp machined edges.)

e. EXTREME care must be taken to avoid "ROLLING" the "O" ring into the counter bore. (A twisted "O" ring is not likely to straighten itself after installation, and is almost certain to leak.) Refer to "GASKETS AND SEALS" under "INTRODUCTION."

f. Care in handling of parts and hydraulic system cleanliness cannot be over stressed.

g. Use ONLY the oil type and viscosity ranges specified under "SERVICE INFORMATION."

### ASSEMBLY

Assemble main relief valve (2, Fig. 11-18) as follows:

Install sleeve (1, Fig. 11-30) in valve body bore being sure hollow end of sleeve is toward relief valve end of bore. Install new "O" ring on poppet cap (3, Fig. 11-17) and install cap in valve body bore opposite relief valve. Seat sleeve against plug. Install new back-up ring (3, Fig. 11-30) and "O" ring (4) in groove of poppet (2). Install piston (5) in poppet (2). After lubricating with clean hydraulic fluid, install poppet assembly in sleeve (1). Install spring (6) over piston (5) in recess of poppet (2). Install new back-up ring (8) and "O" ring (7) in groove in small diameter of plug (10). Install new "O" ring (9) in groove in large diameter of plug (10). Install plug in valve body. After lubricating with clean hydraulic fluid, be sure spring (6) fits in recess of plug. Tighten plug securely. Install pilot poppet (11) in center bore of plug (10). Install spring (12) on pilot poppet stem. Thread adjusting screw (13) into plug bore until it begins to compress spring (12). Place copper washer (14) over adjusting screw (13) and install jam nut (15). Do not tighten jam nut.

Assemble cylinder relief valves (2, Fig. 11-17) (1, Fig. 11-18) as follows:

Install new "O" ring (17, Fig. 11-31) and back-up ring (18) on poppet (19).

Lubricate rings with clean hydraulic fluid. Install large poppet (19) in check valve poppet (9).

Install piston (21) in center bore of poppet (19).

Install small spring (16) over piston (21) and place poppet assembly aside.

Place pilot poppet (13) in center bore of plug (6). Install spring (8) in plug center bore and over stem of pilot poppet (13).

(Continued on next page)

## MAIN CONTROL VALVE - Continued

### ASSEMBLY - Continued

Thread adjusting screw (2) into plug center bore until it begins to compress spring (8).

Install a new back-up ring (10) in groove in center of plug (6). Install a new "O" ring (11) below back-up ring. Install a new "O" ring (7) in groove below flange of plug (6).

Lubricate "O" ring (11) and back-up ring (10) with clean hydraulic fluid. Place large spring (14) over small diameter of plug (6). Carefully slide poppet assembly (9-16-19-21) over plug.

NOTE: Be sure springs (14-16) do not kink or bind and are seated correctly.

Place housing (12) over poppet assembly and thread plug (6) into housing. Hold housing and tighten plug securely.

Install new "O" ring (15) in groove above threads on housing (12). Lubricate "O" ring with clean hydraulic fluid and thread valve into main control valve body (20). Tighten valve assembly securely.

Install a new copper washer (5) on adjusting screw (2). Thread jam nut (4) on adjusting screw. Valve is now ready for adjustment. Refer to "PRESSURE CHECKS AND ADJUSTMENTS." Install copper washer (3) and acorn nut (1) after completing adjustment.

Assemble and install anti-void valves (1, Fig. 11-17) (5, Fig. 11-18) as follows:

a. Lubricate a new "O" ring (8, Fig. 11-20) with clean hydraulic fluid and install in groove in poppet upper portion (7).

b. Place poppet upper portion (7) over stem of lower portion (9) and fasten with lock nut (3). Tighten nut securely.

NOTE: Be sure "O" ring (8) is correctly seated in poppet groove during assembly.

c. Install new back-up ring (6) and "O" ring (5) in groove of poppet assembly.

d. Install spring (2) in recess of plug (1). Lubricate "O" ring (5) and back-up ring (6) with clean hydraulic fluid and install poppet assembly in plug.

e. Install new "O" ring (4) in groove of plug. Lubricate "O" ring with clean hydraulic fluid and install complete assembly in bore of main control valve body. Tighten plug securely.

Assemble and install check valves (1, Fig. 11-32):

Install new "O" rings (5, Fig. 11-32) on valve plugs (4) being careful not to damage "O" ring on plug threads. Install poppets (2) in housing bores. Install valve springs (3) in poppet recesses. Lubricate "O" rings with clean hydraulic fluid and install plugs in housing bores. Be sure valve springs center in plug recesses. Tighten plugs securely.

Assemble and install valve plungers:

Lubricate both valve plungers with clean hydraulic fluid and install in their respective bores. Align "eyes" in ends of plungers and install a 1/2" x 4NF cap screw (1, Fig. 11-34) and hex nut (2). Tighten nut hand tight.

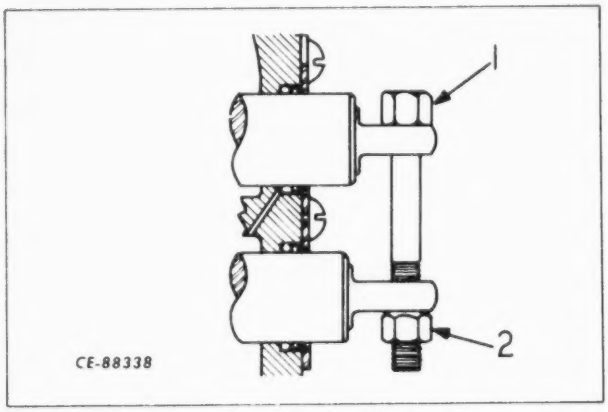



Figure 11-34

Lubricate "O" ring and "slide" (DO NOT ROLL) on to bucket plunger. Lubricate retaining ring and slide on plunger against "O" ring. Using

seal plate as a tool, push "O" ring and retaining ring into seal counter bore in valve housing (Fig. 11-35).

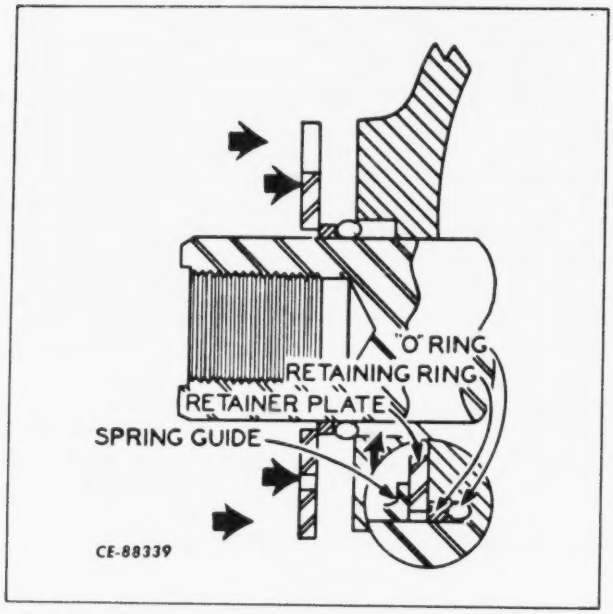



Figure 11-35

Install spring seat (5, Fig. 11-29) on plunger (4) against seal plate (3), insert plunger pin (1) through remaining spring seat and into plunger spring (2). With rod used during disassembly, screw plunger pin assembly into plunger and tighten securely. Use caution to prevent damage to detent ball holes in plunger pin.

Install detent cam (5, Fig. 11-27) and spring (3) in bore of plunger pin (2) after lubricating cam assembly liberally with multi-purpose grease. Place a punch within bore of detent sleeve; depress detent cam with punch, place detent balls (4) in their respective holes and slide sleeve over detent cam assembly. Release punch.

Place plunger cap (3, Fig. 11-23) over detent assembly and firmly against seal plate with screw holes in cap, plate and valve housing (2) properly aligned. Install retaining screws (1) and tighten securely.

Inspect spacer (1, Fig. 11-22) and Spir-O-Lox (2) for damage. Install spacer and Spir-O-Lox being sure Spir-O-Lox is properly seated in detent sleeve groove.

Lubricate piston (2, Fig. 11-21). Insert piston and spacer (3) in bore of detent sleeve. Lubricate new "O" ring (5) and install on plug (4), using caution to avoid cutting ring on plug threads. Install plug in bore of detent sleeve and tighten securely.

Repeat above operations for boom plunger assembly.

NOTE: Spacer (3, Fig. 11-21) is used in bucket plunger only.

Remove cap screw and hex nut from plunger "eyes" (Fig. 11-34). Working one plunger at a time, slide (DO NOT ROLL) a new "O" ring, spacer and split scraper over the plunger. Lubricate all parts thoroughly before installation. Using retainer plate, with a slight rocking motion push assembly into seal counter bore. Install retainer plate cap screws and tighten securely.

Repeat operation for remaining plunger (Fig. 11-36).

(Continued on next page)

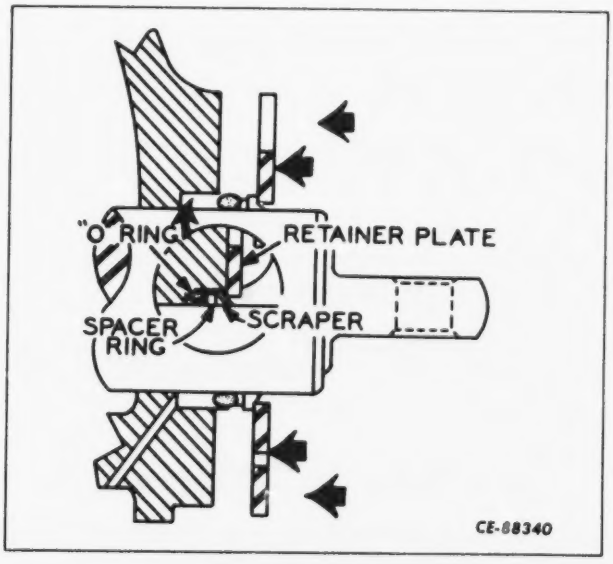



Figure 11-36

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### MAIN CONTROL VALVE - Continued

#### INSTALLATION

Mount assembled valve on tractor. Connect previously tagged lines and control lever linkage. Start engine and operate boom and bucket through several cycles to purge air from system. Adjust relief valves. Refer to "PRESSURE CHECKS AND ADJUSTMENTS." Install copper washer and acorn nut after completing adjustment.

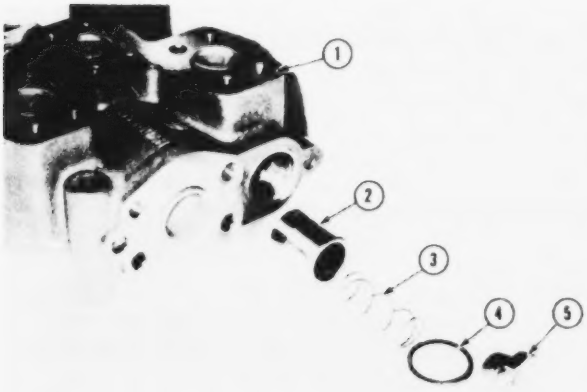
### DEMAND VALVE

#### REMOVAL

Disconnect, cap and tag all connecting lines. Remove cap screws, lock washers and nuts that secure valve to tractor frame.

#### DISASSEMBLY

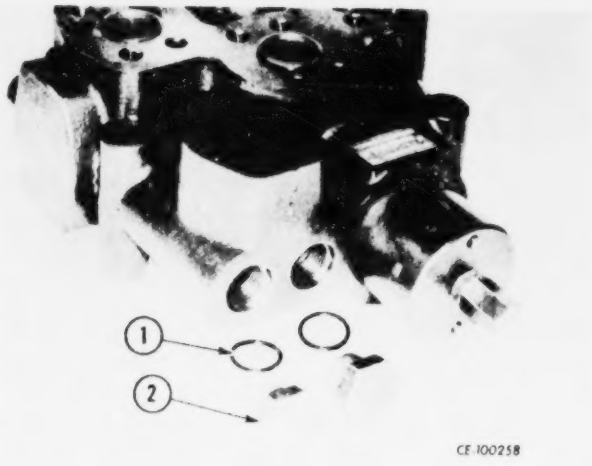
Place valve on a clean bench for disassembly. Remove plug (5, Fig. 11-37), spring (3) and check (2) from bore of valve (1). Remove and discard seal ring (4) from cap.




CE-100257

Figure 11-37

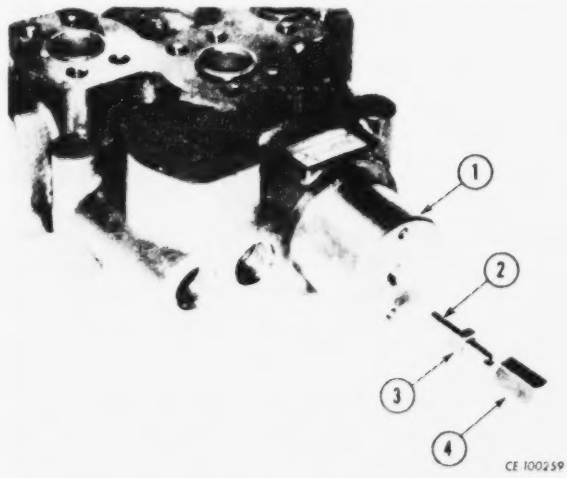
From opposite end of valve remove caps (2, Fig. 11-38) and "O" rings (1). Discard "O" rings.




CE 100258

Figure 11-38

Hold jam nut (3, Fig. 11-39) with a wrench and remove cap (4) from adjustment screw (2) without allowing jam nut to turn. This procedure will preserve relief valve setting. Remove slotted adjusting screw and jam nut from cap (1).




CE 100259

Figure 11-39

Remove cap (6, Fig. 11-40) and spring guide (4). Remove spring (3) from plunger bore. Remove and discard seal ring (5) from cap. Slide plunger (1) from valve body bore. Remove snap-ring (2) from plunger. Remove and discard "O" ring and back-up ring from spring guide.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

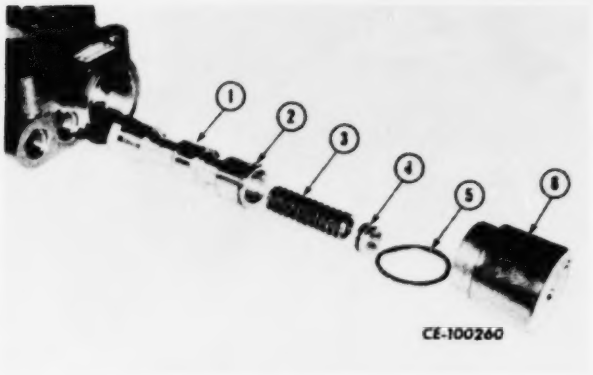



Figure 11-40

### INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace valve assembly. Stone or use crocus cloth on small scores.

All parts with sliding fit must move freely in their bores. All grooves and passages must be free of foreign matter.

Replace springs if they are broken or distorted.

Replace all "O" rings.

Listed below are instructions that must be followed to insure correct installation and effective sealing of "O" rings.

a. Seal counter bores must be thoroughly cleaned.

b. "O" rings, plungers, and counter bores must be lubricated on assembly.

c. "O" rings must be free of molding defects and handling damage.

d. "O" RINGS MUST NOT BE STRETCHED beyond the yield point.

e. EXTREME care must be taken to avoid "ROLLING" the "O" ring into the counter bore. (A twisted "O" ring is not likely to straighten itself after installation, and is almost certain to leak.) Refer to "GASKETS AND SEALS" under "INTRODUCTION."

f. Care in handling of parts and hydraulic system cleanliness cannot be over stressed.

g. Use ONLY the oil type and viscosity ranges specified under "LUBRICANTS AND CAPACITIES."

### ASSEMBLY

Install snap-ring (2, Fig. 11-40) in groove of plunger (1) and carefully slide plunger into valve body bore. Lubricate and install new "O" ring and back-up ring on spring guide (4). Insert spring guide into bore of cap (6). Insert spring (3) into plunger bore.

Install new seal ring (5) in groove of cap (6) and thread cap into valve body. Be sure that spring does not cock or misalign when installing cap. Tighten cap securely.

Thread adjusting screw (2, Fig. 11-39) with jam nut (3) into cap (1). Hold jam nut and thread cap (4) onto screw.

Lubricate new "O" rings (1, Fig. 11-38) and install on caps (2). Thread caps into valve body bores and tighten securely.

Insert spring (3, Fig. 11-37) into check (2) and slide both into bore of valve (1). Install new seal ring on plug (5) and thread plug into valve bore. Tighten plug securely.

### INSTALLATION

Mount assembled valve in tractor and secure it with appropriate hardware. Connect previously tagged lines to their proper ports. Use new "O" rings at all split flange connections. Be sure all connections are tight and leak-free.

## STEERING CONTROL VALVE

### REMOVAL

Disconnect linkage to valve by removing cap screw (1, Fig. 11-41) and nut from link rod. Disconnect, tag and cap all connecting lines. Remove mounting hardware (2) and place valve on a clean bench for disassembly.

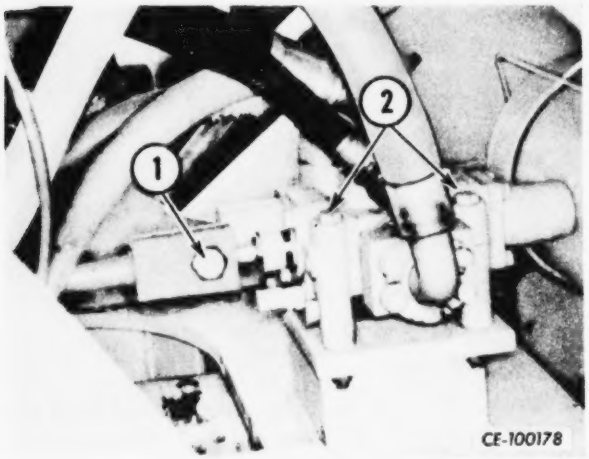



Figure 11-41

### DISASSEMBLY

Remove cap screws (1, Fig. 11-42) securing plunger cap (3) to valve body. Remove cap, exposing plunger (2).

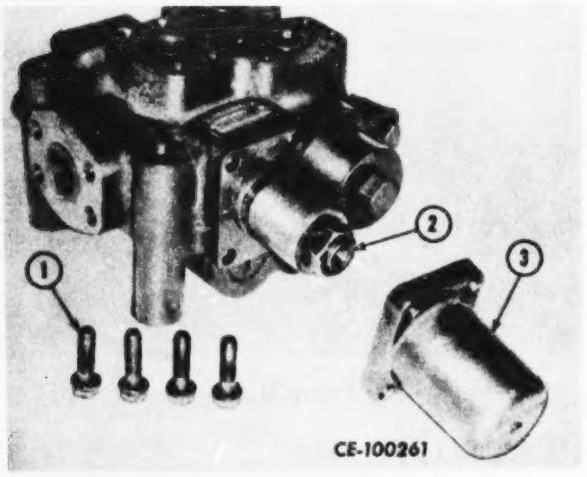



Figure 11-42

Remove cap screws securing plunger seal plate (5, Fig. 11-43) to valve. Remove seal plate and wiper (4). Push plunger (2) into valve bore. Remove and discard seal (3) from valve bore.

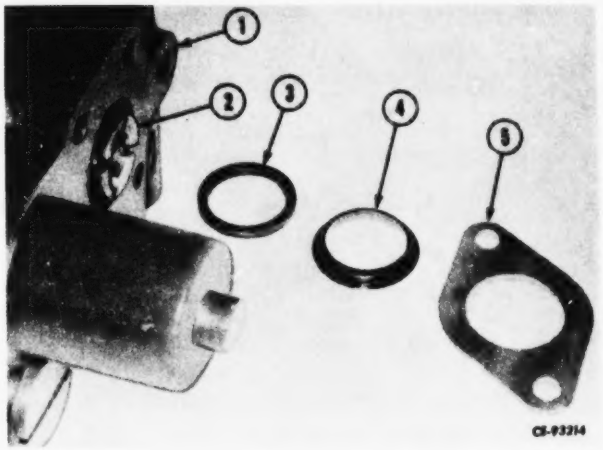



Figure 11-43

Carefully pull plunger assembly (2, Fig. 11-42) from valve. Remove back-up ring (10, Fig. 11-44), shim pack (9) and spacer (8) from plunger (7).

NOTE: Control plunger is adjusted with shims at the factory. Measure thickness of shim pack (9). The same thickness of shims must be used during assembly of valve. If shims are in good condition tie pack together and reuse.

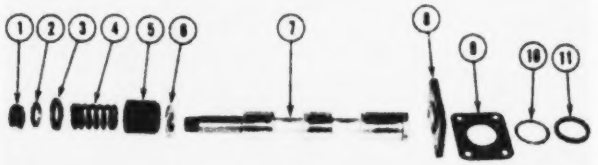



Figure 11-44

Remove nut (1) and slide washer (2), spacer (3), spring (4), spacer (5) and spacer (6) from plunger. Remove seal (11) from valve bore and discard.

Remove cap (4, Fig. 11-45). Slide lock plunger (2) out of valve (1). Remove seal ring (3) from cap.

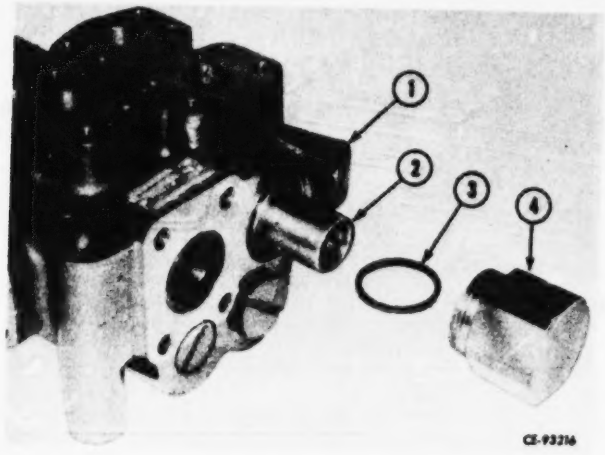



Figure 11-45

Remove snap ring (6, Fig. 11-46) and slide plug (5), spring (3) and check (2) from plunger (1). Remove "O" ring (4) from plug. Repeat procedure for opposite end of plunger.

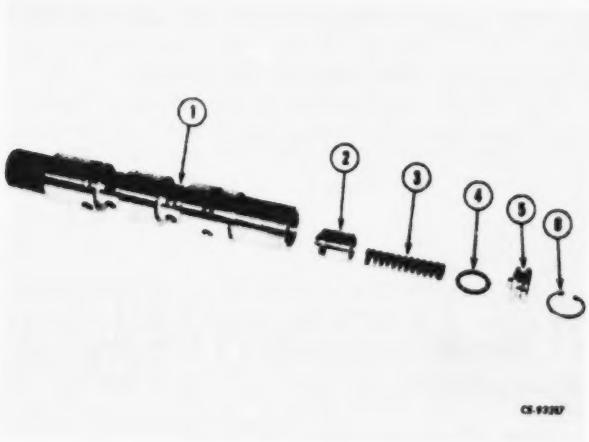



Figure 11-46

Remove cap (4, Fig. 11-47) and slide spring (2) from valve (1). Remove seal ring (3) from cap.

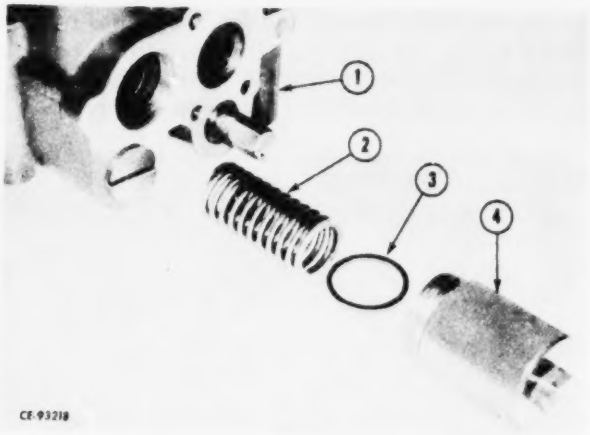



Figure 11-47

Remove acorn nut (5, Fig. 11-48) and washer (4). Hold adjusting screw (3) and loosen jam nut (2). Remove screw and washer (1).

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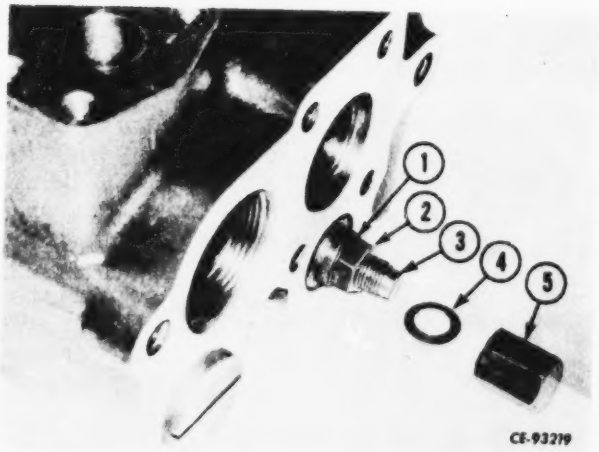


Figure 11-48

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### STEERING CONTROL VALVE - Continued

DISASSEMBLY - Continued

Remove cap (9, Fig. 11-49) and slide spring (7), poppet (6), seat (5), spring (3) and check (2) from valve (1). Remove "O" rings (4 and 8).

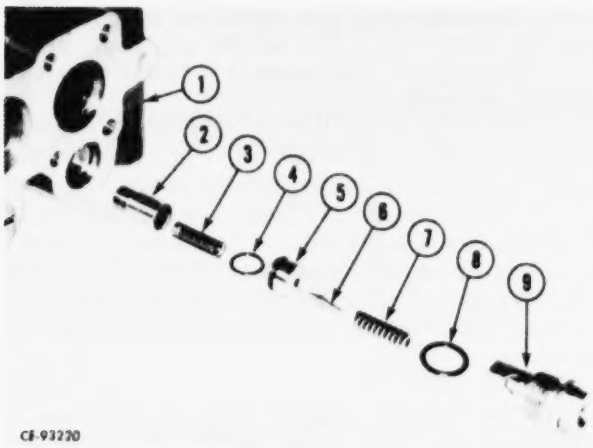


Figure 11-49

Remove cap (7, Fig. 11-50) and slide spring (5), check (4) and seat (3) from valve (1). Remove "O" rings (2 and 6).

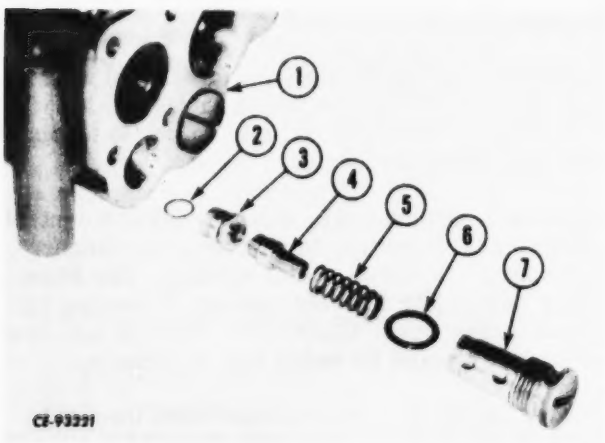


Figure 11-50

Remove cap (5, Fig. 11-51) and slide spring (3) and check (2) from valve (1). Remove seal ring (4).

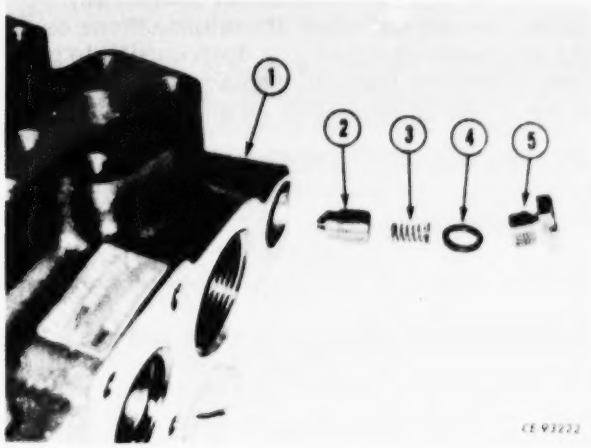


Figure 11-51

Remove seat (6, Fig. 11-52) and slide relief valve (3) and spring (2) from valve (1). Remove "O" ring (4) and seal ring (5). Repeat above procedure for remaining valve.

NOTE: Relief valve (3, Fig. 11-52) is pre-set during manufacture. DO NOT DISASSEMBLE relief valve as once disassembled, pressure setting is lost. If defective, replace entire relief valve.

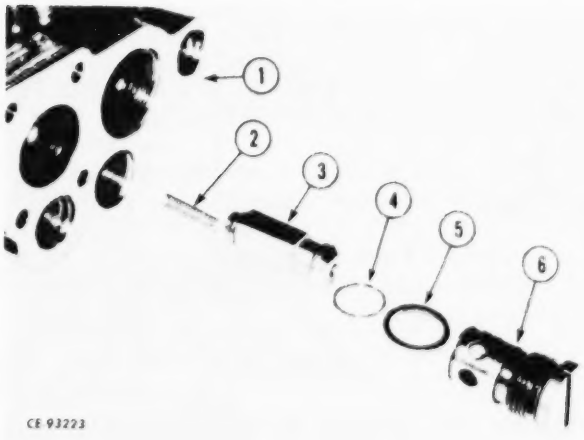


Figure 11-52

INSPECTION

Thoroughly wash all parts in a clean mineral oil solvent. Dry with filtered compressed air and place on clean paper for inspection.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Inspect all surfaces for burrs, scratches, nicks, scores and other abrasions. Stone or lap all burrs. If scoring is deep enough to produce excessive leakage, replace valve assembly. Stone or use crocus cloth on small scores.

All parts with sliding fit must move freely in their bores. All grooves and passages must be free of foreign matter.

Replace springs if they are broken or distorted.

Replace all "O" rings, seal rings and gaskets.

Listed below are instructions that must be followed to insure correct installation and effective sealing of "O" rings.

a. Seal counterbores must be thoroughly cleaned.

b. "O" rings, plungers, and counterbores must be lubricated on assembly.

c. "O" rings must be free of molding defects and handling damage.

d. "O" RINGS MUST NOT BE STRETCHED beyond the yield point.

e. EXTREME care must be taken to avoid "ROLLING" the "O" ring into the counterbore. (A twisted "O" ring is not likely to straighten itself after installation, and is almost certain to leak.) Refer to "GASKETS AND SEALS" under "INTRODUCTION."

f. Care in handling of parts and hydraulic system cleanliness cannot be over stressed.

g. Use ONLY the oil type and viscosity ranges specified under "LUBRICANTS AND CAPACITIES."

### ASSEMBLY

Lubricate new "O" ring (4, Fig. 11-52) and seal ring with petroleum jelly and install on seat (6). Slide spring (2) and relief valve (3) into valve body (1). Install seat and tighten securely. Repeat above procedure for remaining valve.

Lubricate new seal ring (4, Fig. 11-51) with petroleum jelly and install on cap (5). Slide check (2) and spring (3) into valve (1). Install cap and tighten securely.

Lubricate new "O" rings (2 and 6, Fig. 11-50) with petroleum jelly and install on seat (3) and cap (7). Slide seat, check (4) and spring (5) into valve (1). Install cap and tighten securely.

Lubricate new "O" rings (4 and 8, Fig. 11-49) with petroleum jelly and install on seat (5) and cap (9). Slide check (2), spring (3), seat, poppet (6) and spring (7) into valve (1). Install cap and tighten securely.

Install the adjusting screw (3, Fig. 11-48). Turn screw into approximate position at time of removal. Install a new washer (1) with jam nut (2). Install a new washer (4) and acorn nut (5) finger tight. Refer to "STEERING CONTROL RELIEF VALVE" under "PRESSURE CHECKS AND ADJUSTMENTS" for correct adjustment procedure.

Lubricate new seal ring (3, Fig. 11-47) with petroleum jelly and install on cap (4). Slide spring (2) into valve (1) and install cap and tighten securely.

Lubricate new "O" ring (4, Fig. 11-46) with petroleum jelly and install on plug (5). Slide check (2), spring (3) and plug into lock plunger (1). Hold plug down and install snap ring (6). Repeat above procedure for opposite end of plunger.

Lubricate new seal ring (3, Fig. 11-45) with petroleum jelly and install on cap (4). Slide lock plunger assembly (2) into valve (1). Install cap and tighten securely.

Lubricate new seal (11, Fig. 11-44) and control plunger (7). Carefully install seal on plunger shoulder at threaded end of plunger. Use shim stock on plunger to avoid damage to sealing lip of seal. The word "OUTSIDE", molded into seal, must face toward threaded end of plunger.

DO NOT push seal onto plunger past the first land. Slide back-up ring (10), shim pack (9) and spacer (8) onto plunger shoulder. Be careful not to break back-up ring. Assemble spacer (6), spacer (5), spring (4), spacer (3) and washer

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### STEERING CONTROL VALVE - Continued

#### ASSEMBLY - Continued

2) on plunger. Apply "Loctite", Type "A" to plunger threads and assemble nut (1) to plunger. Clamp plunger in a vise between wooden blocks and tighten nut to recommended torque. (Refer to "SPECIAL TORQUES.")

Plunger nut torque: _____

Carefully slide control plunger (2, Fig. 11-43) into valve (1) until shoulder with seal (11, Fig. 11-44) is far enough within valve bore to allow seal to be pressed into its seat in bore. DO NOT at any time allow seal to move off plunger shoulder into groove. Align cap screw holes in shim pack, spacer and plunger cap (3, Fig. 11-42) and secure with cap screws. (Refer to "SPECIAL TORQUES.")

Torque: _____

Lubricate new seal (3, Fig. 11-43) and plunger (2). Carefully slide seal onto plunger shoulder and press into seat in valve bore. Observe precautions outlined above to avoid seal damage. Install wiper (4) and seal plate (5) and secure with cap screws.

#### INSTALLATION

Mount valve in tractor and secure with mounting hardware (2, Fig. 11-41). Connect link rod to valve spool by installing cap screw (1) and nut. Connect previously tagged lines to their proper ports, using new "O" rings.

### HYDRAULIC CYLINDERS - BOOM AND BUCKET

#### GENERAL

Replace cylinder packing when excessive leakage occurs. To replace packing, the cylinder must be disassembled.

#### REMOVAL

Drain the cylinder to be removed as much as possible. Tape, plug and tag the disconnected lines to protect and identify them for assembly. Do not damage the pivot bushings or port flanges during removal.

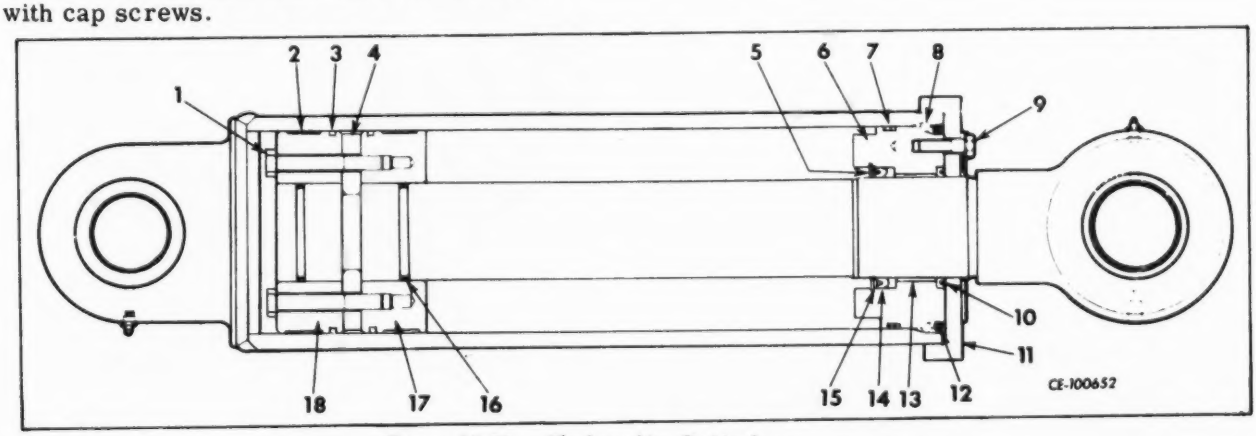


Figure 11-53 Hydraulic Cylinder

1. Pellet type bolt.
2. Wear ring.
3. Seal assembly.
4. Lockring.
5. Retaining ring.
6. Cap.
7. "O" ring and back-up rings.
8. Segmented lockring.
9. Bolt and lockwasher.
10. "O" ring seal.
11. Cover.
12. Cord ring.
13. Bushing.
14. Packing.
15. Bushing.
16. "O" ring and back-up rings.
17. Piston half.
18. Piston half.



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

NOTE: The following instructions describe the disassembly, inspection and assembly of a typical large hydraulic cylinder. A variation in parts configuration may be found between cylinders of different application on any given machine; however, the basic design remains the same.

### DISASSEMBLY

Disassemble cylinder in a clean area as follows:

Remove cap screws and lock washers (2, Fig. 11-54) that retain cylinder end cover (3) to cylinder (1).

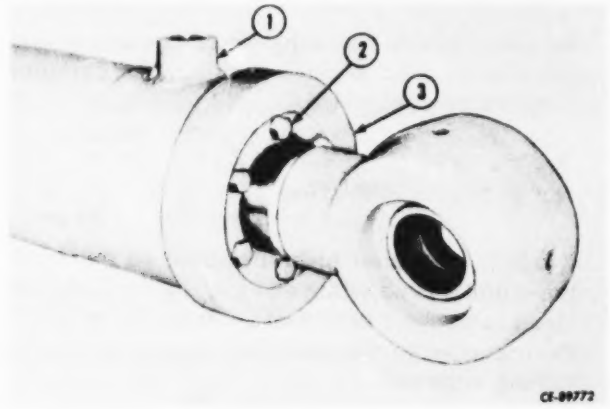


Figure 11-54

Slide cover (3, Fig. 11-53) down rod and remove cord ring (2) from cylinder and "O" ring from cap.

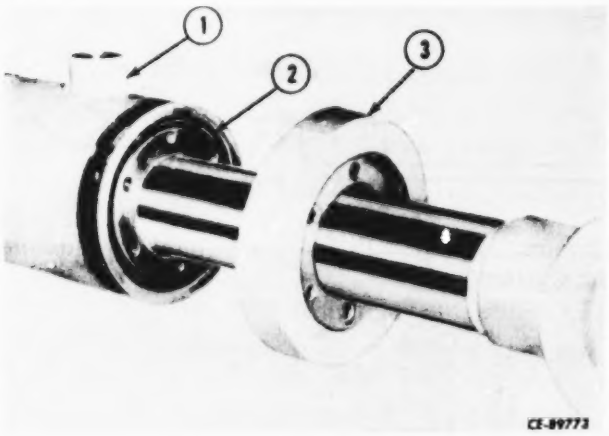


Figure 11-55

Push cap assembly (1, Fig. 11-56) in slightly and remove multi-piece lock ring (2).

Pull rod free of cylinder. Cylinder cap and cover assemblies will come out with rod and piston.

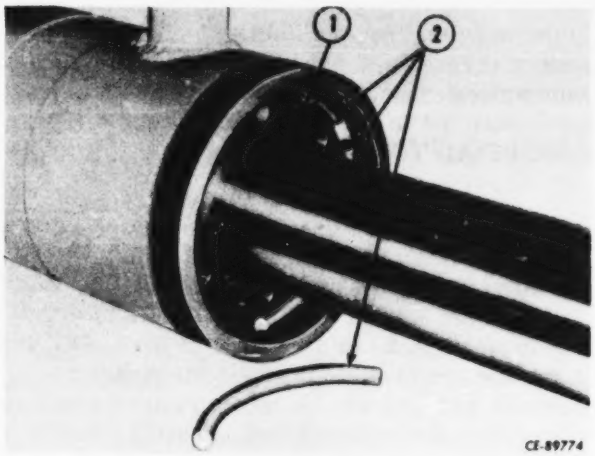


Figure 11-56

Disassemble piston halves by removing pellet type cap screws (1, Fig. 11-57). Discard used cap screws.

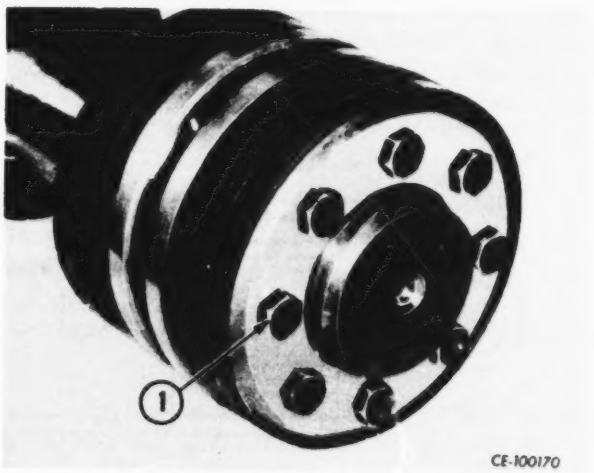


Figure 11-57

Figure 11-58 shows the early type piston and piston packing. Late type construction as shown in Fig. 11-59 has wear rings (6) and seal rings (5) in place of packing shown in Fig. 11-58. Piston halves (2, 4, Fig. 11-59) must be ordered also when rebuilding early cylinders to accomodate new wear rings (6) and seal rings (5). (Refer to current Parts Catalog.)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### HYDRAULIC CYLINDERS - BOOM AND BUCKET - Continued

DISASSEMBLY - Continued

Remove and discard used piston packing (3, Fig. 11-58), bushing (2) and piston halves (4) from early type cylinders - wear ring (6, Fig. 11-59) and seal assemblies (5) from late type cylinders. DO NOT discard lock ring halves (1, Fig. 11-58) (3, Fig. 11-59).

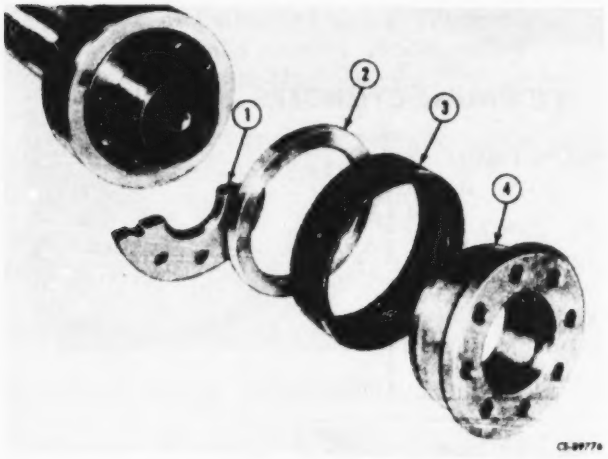


Figure 11-58
Early type piston assembly

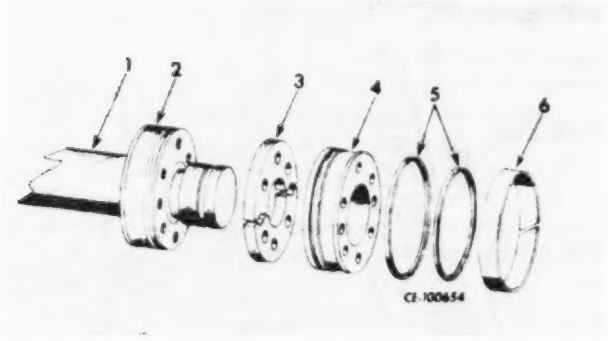


Figure 11-59
Late type piston assembly

Remove and discard "O" rings and back-up rings (16, Fig. 11-53) from grooves in piston end of rod. Remove retaining ring (5) from bore of cap (6) and slide cap assembly from rod. Remove and discard "O" ring and back-up ring (7). Complete cap disassembly by removing packing (14) and discarding it.

INSPECTION

Wash all metal parts including cylinder in solvent. Dry all parts with filtered compressed air. Protect components with a light film of oil. Flush cylinder with oil to remove all traces of solvent and protect cylinder walls from oxidation.

Check cylinder bore and rod surface for scratches and/or abrasions that may have been caused by grit deposits in the cylinder packings. Carefully remove small rough or sharp surfaces with a fine grained stone. The closer these surfaces are to a mirror finish, the more efficiently the new packing will operate.

ASSEMBLY

Slide cylinder cover (11, Fig. 11-53), cord ring (12) and seal ring (10) on rod. Install new "O" ring and back-up ring (7) on cap (6). Lubricate rod and cap bushing (13) and slide cap onto rod. Install new packing (14) in bore of cap and secure with bushing (15) and lockring (5).

Install new "O" rings and back-up rings (16) in grooves in piston end of rod. Install new seal assemblies (5, Fig. 11-59) and wear rings (6) on piston halves (2, 4). Slide piston half having tapped holes (2) onto rod just past lockring groove. Slide outer piston half (4) onto rod, almost to lockring groove. Insert one lockring (3) half between piston halves and seat in rod lockring groove. Align bolt-holes in piston halves and lockring. Insert two pellet type bolts (1, Fig. 11-53) and start them into tapped holes



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in inner piston half (2, Fig. 11-59). Repeat procedure for second lockring half. Install balance of new pellet-type bolts and tighten evenly to recommended torque. Refer to "SPECIAL TORQUES".

Pellet type bolt torque
For boom cylinders _____
For bucket cylinder _____

Coat assembled piston with clean hydraulic oil and carefully start piston and rod assembly into cylinder. Do not damage wear rings or seal assemblies. When piston has fully entered cylinder, carefully push cap assembly (6, Fig. 11-53) into cylinder, being careful not to damage "O" ring and back-up ring (7). Be sure "O" ring and back-up ring are properly positioned, i.e., "O" ring inside, back-up ring outside.

Install segmented lockring (2, Fig. 11-56) in cylinder recess. If needed, use a heavy oil soluble grease to hold lockring segments in place. Install new cord ring (2, Fig. 11-55) in cylinder and new "O" ring (10, Fig. 11-53) in cap recess. Secure end cover (3, Fig. 11-54) to cap with capscrews and lockwashers (2).

Manually extend rod sharply several times, driving piston against cap assembly. This will cause the segmented lockring to seat properly. Tighten cover capscrews to recommended torque. (Refer to "SPECIAL TORQUES".)

Boom cylinders _____
Bucket cylinder _____

### INSTALLATION

Carefully install cylinder on tractor. Do not damage cylinder bushings during installation. Connect previously tagged lines to cylinder, using new "O" rings.

After installing cylinder on tractor, start engine and allow hydraulic oil to reach operating temperature. Cycle cylinder several times. Retorque cap screws with cylinder under pressure.

## HYDRAULIC CYLINDERS - STEERING

### GENERAL

Replace cylinder packing when excessive leakage occurs. To replace packing, cylinder must be disassembled.

### REMOVAL

Drain cylinder to be removed as much as possible. Plug and tag disconnected lines to protect and identify them for assembly. Do not damage pivot bushings during removal.

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### HYDRAULIC CYLINDERS - STEERING - Continued

#### DISASSEMBLY

Disassemble cylinder in a clean area as follows:

a. Loosen set screws (5, Fig. 11-60) and remove rubber plug (2).

b. Rotate cylinder cap until hole in cap is aligned with plug hole in cylinder. Insert a steel rod or punch in holes to prevent cap from turning and remove packing nut (4). Remove retaining ring (3).

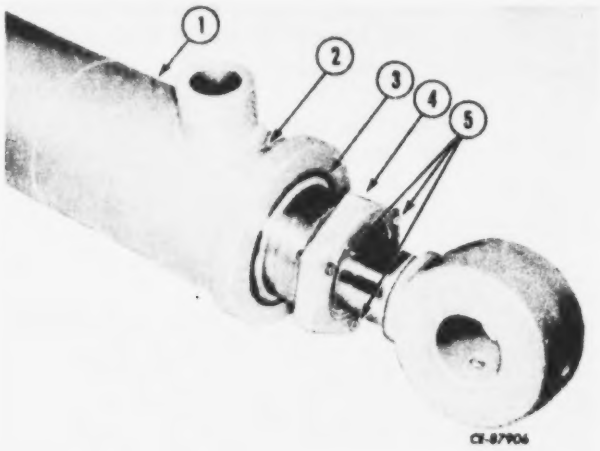


Figure 11-60

c. Extend rod (3, Fig. 11-61) and slide end cover (2) down rod. Push cap assembly (1) in slightly and remove multi-piece ring (4).

d. Pull rod free of cylinder. Cylinder cap and cover assemblies will come out with rod and piston.

Disassemble piston halves by removing pellet type cap screws (1, Fig. 11-57) and separating halves. Discard used cap screws. Remove and discard used piston packing (3, Fig. 11-58) from both piston halves.

NOTE: Do not discard piston halves (4), lock ring halves (1) or bushings (2). Remove remaining parts from rod.

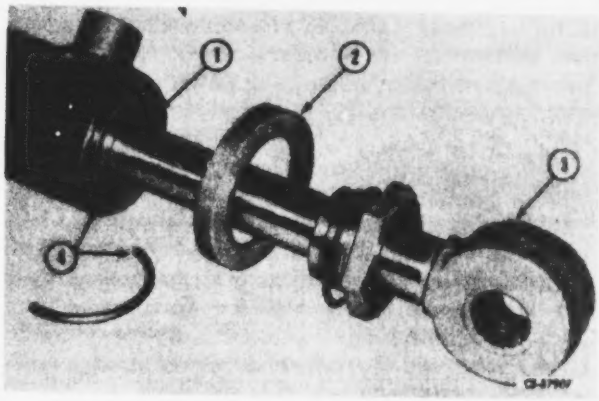


Figure 11-61

Remove and discard "O" ring (21, Fig. 11-62), back-up ring (11) and rod packing (22) from cylinder cap (12). Remove and discard gland nut seal (15).

#### INSPECTION

Wash cylinder parts in solvent and dry with filtered compressed air.

Flush cylinder with oil to remove all traces of solvent and protect cylinder walls from oxidation. Protect all parts with a light oil film. Check inside cylinder surface for scratches and pitted areas. Use a fine grained hand stone to remove surface irregularities. The closer rod and cylinder surfaces are to a mirror-like finish, the more efficiently the new packing can operate.

Check new packing sets for cuts or other possible flaws. Do not use incomplete or defective packing sets. Soak new packing in oil so they will be pliable during installation.

NOTE: Special Torque, Pressure etc. recommendations are listed under "SERVICE INFORMATION." This simplifies revision when necessary. To eliminate constant referral, blank spaces are provided at points where special information is required. These may be filled in by the manual holder, in pencil, and revised when necessary.

#### ASSEMBLY

Insert new rod packing (22, Fig. 11-62) into cylinder cap (12), one ring at a time. Use a



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

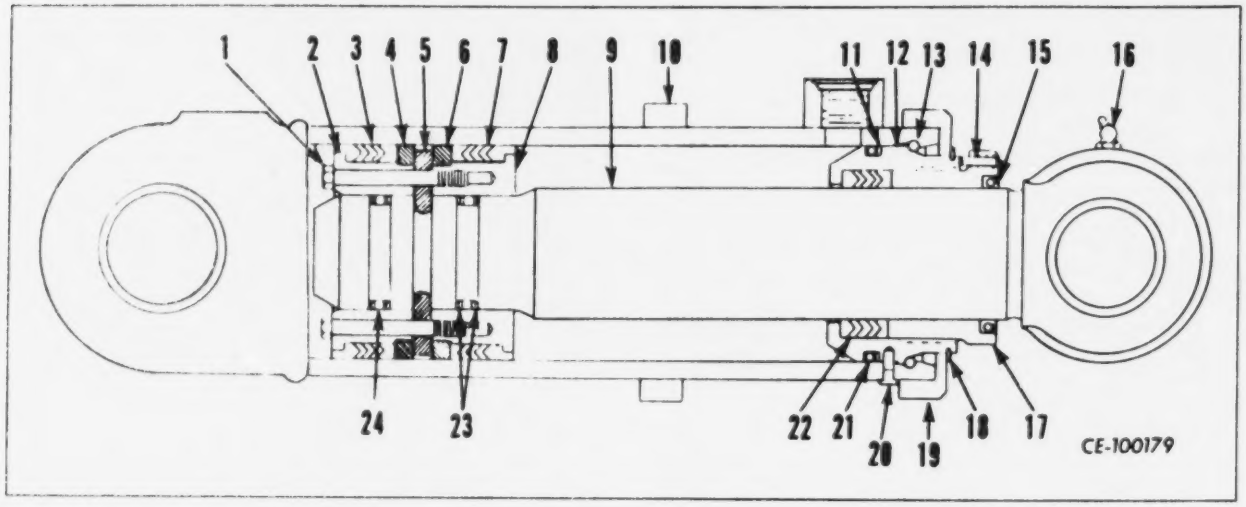


Figure 11-62
Steering Cylinder.

1. Cap screw.
2. Piston half.
3. Packing.
4. Bushing.
5. Lock ring.
6. Bushing.
7. Packing.
8. Piston half.
9. Piston rod.
10. Cylinder.
11. Back-up ring.
12. Cylinder cap.
13. Lock ring.
14. Set screw.
15. Seal.
16. Grease fitting.
17. Packing nut.
18. Snap ring.
19. Cap.
20. Plug.
21. "O" ring.
22. Packing.
23. Back-up ring.
24. "O" ring.

wooden stick with smooth, rounded edges to press new packing into place. The point of the "V" of each ring must point toward threaded opening of cylinder cap.

Install new "O" ring seal (21) and back-up ring (11) in outer groove of cylinder cap (12). Install a new wiper seal (15) in gland nut (17).

Coat piston rod with thin film of oil and slide gland nut onto rod. Be careful not to damage wiper seal in nut.

Slip retaining ring (18), end cap (19) and cylinder cap assembly onto rod. Be careful not to tear or nick rod packing in cylinder cap (12).

Carefully install piston half with threaded holes, on rod. Do not damage "O" rings. Install one half of packing set (3, Fig. 11-58) with open end of "V" facing lip on piston half. Install a bushing (2) on piston against packing. Install remaining half of packing set on piston half with smooth bore holes. Open end of "V" must face lip of piston half. Install a bushing (2) on piston against packing. Start remaining piston half on rod. Do not damage "O" ring. Insert one section of lock ring (1) between piston halves and start a new pellet type piston cap screw (1, Fig. 11-57). Position remaining half of lock ring and install balance of piston cap screws. Tighten cap screws to recommended torque. (Refer to "SPECIAL TORQUES.")

Piston cap screw torque: _____

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### HYDRAULIC CYLINDERS - STEERING - Continued

#### ASSEMBLY - Continued

Coat piston with a film of oil and insert piston and rod assembly into cylinder. To prevent damage to piston packing rings, wrap piston with shim stock. Remove shim stock as piston starts into cylinder bore.

Slide cylinder cap (12, Fig. 11-62) end cap (19) and retaining ring (18) toward cylinder. Push cap assembly into cylinder. Be sure "O" ring and back-up ring on outside of cap are correctly positioned. Install multi piece lock ring (4, Fig. 11-61) in cylinder recess.

Pull piston rod out until head locks against lock ring. Install cylinder end cover (2) and its retaining ring.

Turn packing gland nut (4, Fig. 11-60) in until it seats on rod packing in head. Turn head assembly by turning nut until a metal keeper can be inserted through hole (2) in rod end of cylinder and head assembly.

With head locked in position, adjust gland nut to obtain proper compression of head packing. Remove steel rod and install rubber plug (2). Lock gland nut in place with set screws (5).

When properly adjusted, only a light film of oil will appear on piston rod.

#### INSTALLATION

Mount cylinder in original position in tractor. Exercise care to avoid damage to cylinder pivot bushings. Connect previously tagged lines. Be sure all connections are tight and leak-free.

## TROUBLE SHOOTING

### GENERAL

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Poor hydraulic system performance or failure. | 1. Defective pump. | |
| | 2. Dirt in relief valve. | 2. Disassemble and clean. |
| | 3. Relief valve defective. | |
| | 4. Worn cylinders. | |
| | 5. Load too heavy. | 5. Check line pressure. |
| | 6. Internal crack. | 6. Replace valve assembly. |
| | 7. Plunger not in full stroke. | 7. Check movement and linkage. |
| | 8. Reservoir low on oil. | |
| | 9. System filters clogged. | |
| | 10. Restrictions in lines. | |


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## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Excessive oil foaming. | 1. Improper type or viscosity oil.<br>2. Excessive by-passing of oil over relief valves. | 1. Refer to "LUBRICANTS AND CAPACITIES."<br>2. Adjust relief valve per recommendation if pressure adjustment is too low.<br>Repair damaged relief valve.<br>Change operating methods to eliminate long periods of maximum pressure operation. |
| Excessive oil temperature. | 1. Sustained maximum pressure operation with by-passing of oil over relief valves.<br>2. Incorrect viscosity or type of oil.<br>3. Worn hydraulic pump. | 2. Refer to "LUBRICANTS AND CAPACITIES." |
| Foreign material in reservoir screens. | 1. Lint - Worn, frayed or damaged cylinder packing.<br>2. Chips - Worn pump or damage in cylinders. | 1. Replace packing.<br>2. Disassemble system components, inspect and repair. |
| Insufficient pressure build-up. | 1. System relief valve set too low.<br>2. Worn pump components causing internal leakage. | 1. Adjust relief valve according to specifications. Refer to "Main Relief Valve Adjustment." |
| Low pressure in boom circuit. | 1. Damaged, worn or improperly adjusted hydraulic relief valve.<br>2. By-pass in cylinders.<br>3. Hydraulic pump worn. | |

(Continued on next page)

## GENERAL - Continued

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Low pressure in bucket circuit. | 1. Refer to causes 1, 2, and 3 in "Boom Circuit" above. | |
| Low pressure in steering circuit. | 1. Damaged, worn or improperly adjusted steering circuit relief valve. | |
| | 2. By-pass in steering cylinders. | 2. Inspect cylinders and rebuild if necessary. |
| | 3. Worn steering pump. | |

## MAIN CONTROL VALVE

| | | |
|---|---|---|
| Difficult operation or sticking of control valve plungers. | 1. Over-heated hydraulic oil. | 1. Refer to "Excessive Oil Temperature." |
| | 2. Dirt in valve bores, plungers and/or oil. | 2. Change oil, clean valve and entire system. |
| | 3. Valve warped from incorrect mounting procedure. | 3. Loosen mounting cap screws and tighten evenly. |
| | 4. Fittings too tight. | |
| | 5. Excessively high pressure in valve. | 5. Check pressures on inlet and outlet lines. |
| | 6. Linkage binding. | |
| | 7. Plunger bent. | 7. Replace valve assembly. |
| | 8. Detent or return spring damaged. | 8. Replace necessary parts. |
| | 9. Spring or detent cap binding. | 9. Loosen cap, recenter and retighten. |
| | 10. Valve not at thermal equilibrium. | 10. Allow system to warm-up. |
| Unable to move plunger in or out. | 1. Dirt in valve. | |
| | 2. Plunger cap full of oil. | 2. Replace seals. |
| | 3. Bind in linkage. | |

## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Detent control fails to hold. | 1. Worn detent cam.<br>2. Spring or ball broken or deformed.<br>3. Excessive vibration.<br>4. Plunger stroke restricted. | |
| Load drops when plunger moved from neutral. | 1. Dirt in check valve.<br>2. Scored check valve poppet or seat. | |
| Load will not hold. | 1. Cylinder leaking or worn.<br>2. Oil by-passing valve plunger. | 2. Replace valve assembly. |
| Leaking seals. | 1. Paint on or under seal.<br>2. Excessive back pressure.<br>3. Dirt under seal.<br>4. Scored plunger.<br>5. Loose seal plates.<br>6. Cut or scored seal. | 2. Open line to reservoir. |

## MAIN CONTROL VALVE - MAIN PRESSURE RELIEF VALVE

| | | |
|---|---|---|
| No pressure. | 1. Large poppet, check valve poppet or pilot poppet stuck open or dirt under valve seat. | 1. Check for foreign material between poppets and their mating members. Members must slide freely. Clean all parts thoroughly. |
| Erratic pressure. | 1. Pilot poppet seat damaged. Small poppet sticking in large poppet. | |
| Pressure setting incorrect. | 1. Wear due to dirt. Jam nut and adjusting screw loose. | |
| Leaks. | 1. Damaged seats, worn "O" rings.<br>2. Parts sticking due to dirt. | |

## TROUBLE SHOOTING

### MAIN CONTROL VALVE - ANTI-VOID VALVE

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Valve inoperative. | 1. Sensing hole in small poppet plugged.<br>2. Poppet sticking. | |

### PUMP

| | | |
|---|---|---|
| Pump does not deliver fluid. | 1. Shaft sheared or disengaged.<br>2. Reservoir-to-pump intake line restricted.<br>3. Fluid viscosity too heavy to pick up prime.<br>4. Relief valve stuck open.<br>5. Vane(s) stuck in the rotor slot(s). | |
| Pump making noise. | 1. Low oil supply.<br>2. Cavitation in hydraulic pump.<br>3. Air in pump oil supply.<br>4. Excessive fluid foaming.<br>5. Vortex or spiral in oil circulating in reservoir.<br>6. Excessive pump speeds.<br>7. High engine speeds with cold hydraulic oil.<br>8. Hydraulic oil viscosity too high.<br>9. Pump components in mis-alignment. | 2. Clear obstruction to pump oil supply.<br>5. Check installation and condition of suction screens. Check oil level.<br>6. Adjust engine governed speeds.<br>7. Warm-up engine and hydraulic system prior to high speed or full load operation. |

## TROUBLE SHOOTING

### STEERING CONTROL VALVE

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Hard steering when turning slowly. | 1. Low fluid level in reservoir.<br>2. Low oil pressure due to kink in hose.<br>3. Low oil pressure due to foreign object stuck in hose.<br>4. Pressure loss in cylinder(s) due to worn piston packing and/or rod packing.<br>5. Steering control valve leaks.<br>6. Loose fit of spool in valve body. | 1. Fill to proper level. If excessively low, check all lines and connections for evidence of external leakage. |
| No effort required to turn. | 1. Loose or worn valve. | |
| Poor steering return. | 1. Sticky valve spool. | 1. Remove and clean or replace valve. |
| Tractor leads to one side or the other. | 1. Unbalanced or badly worn valve.<br>NOTE: If this is the cause, steering effort will be very light in direction of lead and heavy in opposite direction. | |
| Momentary increase in effort required when turning wheel fast. | 1. Insufficient oil supply to pump.<br>2. High internal leakage. | |
| Excessive wheel kick-back or loose steering. | 1. Air in system. | 1. Add fluid to reservoir. |

# HYDRAULIC SYSTEM

## SERVICE INFORMATION

### COMPONENT SPECIFICATIONS

#### RESERVOIR

Type:
Closed system with controlled pressure and vacuum relief.

Construction:
Cylindrical shape with 1/8 inch wall thickness, 19-3/4 inch diameter x 34-3/4 inches high and removable cover.
Vacuum valve setting, 2.3 psi.
Pressure relief valve setting, 30 psi.
Relief valve spring, correct adjusted length, 3 inches.
Pressure required to deflect relief valve spring 1/10 inch, 6.7 lbs.

Filters:
Four replaceable, pleated paper, radial fin type elements rated at 5 microns each.
Burst pressure, 100 psi minimum.
Flow rate, inside out, 60 GPM at 15 psi with SAE 10 oil at 100°F.
Strainers #6 square mesh wire cloth.
Capacity, "H" mark on dipstick = 35 gals., reservoir only.

#### PUMPS

Type:
Main pump: vane, double element, positive displacement.
Steering pump: vane, single element, positive displacement.

Rotation:
Counterclockwise as viewed from shaft end.

Pump capacity: (1200 rpm, 100 psi.)
Main pump:
Small element, 21 GPM.
Large element, 38 GPM.
Steering pump: 25 GPM.

#### MAIN CONTROL VALVE

Type:
Two spool, balanced spool design with integral pilot operated relief valve.

Relief valve setting:
Main relief - 2300 ± 50 psi at full throttle
Cylinder relief - 3000 ± 50 psi at full throttle

Rating:
102 GPM at velocity of 22 ft/sec.

#### STEERING VALVE

Type:
Plunger operated.

Circuit pressures: Refer to "SYSTEM PRESSURES."

#### DEMAND VALVE

Type:
Pressure operated, non-adjustable.

#### HYDRAULIC CYLINDERS

BOOM CYLINDERS

Type: Double acting.
Diameter of bore, 6 inches.
Stroke (pin C/L to pin C/L), 50 inches.
Extended length (pin C/L to pin C/L), 120 inches.
Retracted length (pin C/L to pin C/L), 70 inches.

BUCKET CYLINDER

Type: Double acting.
Diameter of bore, 8 inches.
Stroke (pin C/L to pin C/L), 21-1/2 inches.
Extended length (pin C/L to pin C/L), 79-1/2 inches.
Retracted length (pin C/L to pin C/L), 58 inches.

STEERING CYLINDERS

Type: Double acting.
Diameter of bore, 4-1/2 inches.
Stroke (pin C/L to pin C/L), 20-1/2 inches.
Extended length (pin C/L to pin C/L), 58 inches.
Retracted length (pin C/L to pin C/L), 37-1/2 inches.

#### LINKAGE RATE OF TRAVEL

Boom raises, empty, 6.7/7.5 sec.
Boom lowers, empty (float position) 4.8/5.4 sec.
Bucket retracts, empty, 2.5/2.9 sec.
Bucket dumps, empty, 1.9/2.3 sec.



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## SERVICE INFORMATION

## LUBRICANTS AND CAPACITIES

LUBRICANT

| TEMPERATURE | TYPE REFILL AND SERVICE | | |
|---|---|---|---|
| | SAE | API | MILITARY SPECIFICATIONS |
| Below 20°F. | 10W/30 | ** | ** |
| Above 20°F. | 20-20W | CC or CD | MIL-L-2104B, MIL-L-45199B |

** Wear test sequence

CAPACITY

Initial fill (dry system) . . . . . 60 gals.
Refill (approx) . . . . . 54 gals.

## SPECIAL TORQUES

HYDRAULIC RESERVOIR

Filter retaining plate nuts . . . 15-20 ft. lbs.
Cover retainer cap screw nuts . . . 20 ft. lbs.

HYDRAULIC PUMP - MAIN

Outlet cover retaining cap screws . . . 65-75 ft. lbs.
Inlet housing-to-body cap screws . . . . 85-95 ft. lbs.

HYDRAULIC PUMP - STEERING

Cover retaining cap screws . . 85-95 ft. lbs.

CYLINDERS

Boom cylinder piston cap screws . . 70 ft. lbs.
Boom cylinder cap screws (under pressure) . . . . . 35 ft. lbs.
Bucket cylinder piston cap screws . 170 ft. lbs.
Bucket cylinder cap screws (under pressure) . . . . . 85 ft. lbs.
Steering cylinder piston cap screws . 35 ft. lbs.

Pellet type bolts:
Boom cylinders . . . . . 70 ft. lbs.
Bucket cylinder . . . . . 170 ft. lbs.

## SYSTEM PRESSURES

Main relief valve . . . . . 2000 psi
Cylinder relief valve . . . . . 3000 psi
Steering relief valve:
Main pressure . . . . . 2000 psi
Service ports . . . . . 3500 psi
Vacuum: Pressure relief valve
Pressure, crack . . . . . 30 psi
Vacuum, crack . . . . . 0 psi to .3 psi

## PRESSURE CHECKS AND ADJUSTMENTS

MAIN RELIEF VALVE

In addition to the regular periodic system pressure checks and checks to detect system problems, the main relief valve must be pressure checked and adjusted if it has been completely disassembled or if repairs have been made to the hydraulic system.

The pilot section of the relief valve may be removed without disturbing the valve setting.

(Continued on next page)

## SERVICE INFORMATION

### PRESSURE CHECKS AND ADJUSTMENTS Continued

#### MAIN RELIEF VALVE - Continued

By loosening and removing the plug (6, Fig. 11-63) the pilot section may be lifted from the main control valve body.

◆ CAUTION: BEFORE ATTEMPTING TO ADJUST PRESSURE RELIEF VALVE, ALIGN FRAME HALVES AND INSTALL TRACTOR SAFETY BAR IN STRAIGHT AHEAD POSITION. DO NOT MOVE STEERING WHEEL WHILE ADJUSTING HYDRAULIC SYSTEM MAIN RELIEF VALVE.

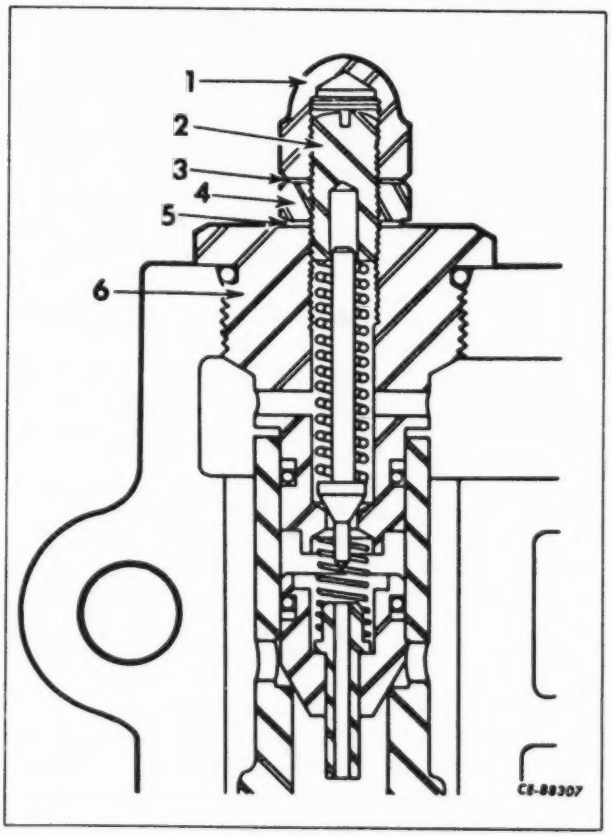


Figure 11-63
Main Relief Valve.

Adjust relief valve as follows:

a. Remove pipe plug from main control valve and install a test gauge (3000 psi capacity).

b. Start engine and check for leaks around relief valve. Plugs at either end of relief valve bore must be tight.

c. Remove acorn nut (1) from adjusting screw (2). It will be necessary to hold jam nut (4) while removing acorn nut.

d. Accelerate engine to "High Idle" and hold bucket control lever in "Rolled Back" (retracted) position. Note indicated pressure on gauge.

e. Idle the engine. If indicated pressure was not within recommended limits, adjustment is necessary. Refer to "SYSTEM PRESSURES" for recommended setting.

f. Hold adjusting screw (2) and loosen jam nut (4). To adjust pressure hold jam nut and rotate adjusting screw clockwise to increase and counterclockwise to decrease pressure. Recheck indicated pressure. When correct pressure is obtained, hold adjusting screw and tighten jam nut.

g. Be sure copper washer (3) is in good condition and install acorn nut (1).

h. Stop engine. Remove test gauge and replace pipe plug.

#### BUCKET CIRCUIT RELIEF VALVES

Bucket circuit relief valves are adjusted at the factory and will seldom require adjustment. These valves are designed to protect the bucket during closed circuit operation, that is during back-dragging or leveling (Fig. 11-64) when the bucket control lever is in the "Hold" position. Resistance developed at the cutting edge is transferred to the loader linkage. Unless protected by the circuit relief valves these pressures, if excessive, could inflict serious damage on the loader linkage.



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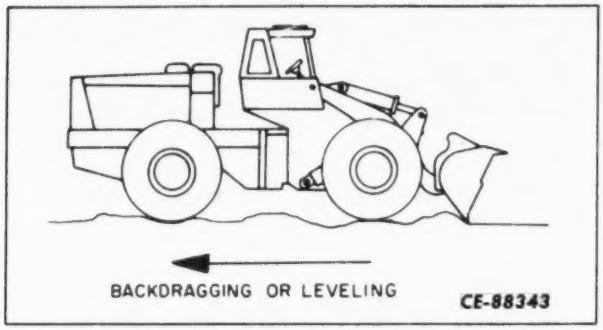


Figure 11-64

To adjust bucket circuit relief valve:

a. Place bucket on ground and all controls in "Hold" or "Neutral." Apply parking brake.

b. Insert a tee connection in hydraulic line on high pressure side of each relief valve.

c. Insert a hose connected to a 5000 psi gauge in stem of each tee. Gauge hoses must be long enough to reach to operator's compartment.

d. Check oil level in reservoir and add oil if necessary.

e. Start engine. Raise boom slightly and retract bucket 3/4 of its travel. Release bucket control lever as soon as bucket reaches desired position.

f. Release parking brake and move tractor forward, allowing underside of bucket cutting edge to contact an immovable object. Contact must be along full length of edge.

g. By depressing accelerator increase pressure on cutting edge. Note pressure at which valve discharges. This pressure should equal recommended maximum. Refer to "SYSTEM PRESSURES."

h. If an adjustment is required hold jam nut (4, Fig. 11-65) and remove acorn nut (1). Hold adjusting screw (2) and loosen jam nut. Rotate adjusting screw in a clockwise direction to increase and counterclockwise direction to decrease pressure. Again check valve discharge pressure. Continue test and adjust

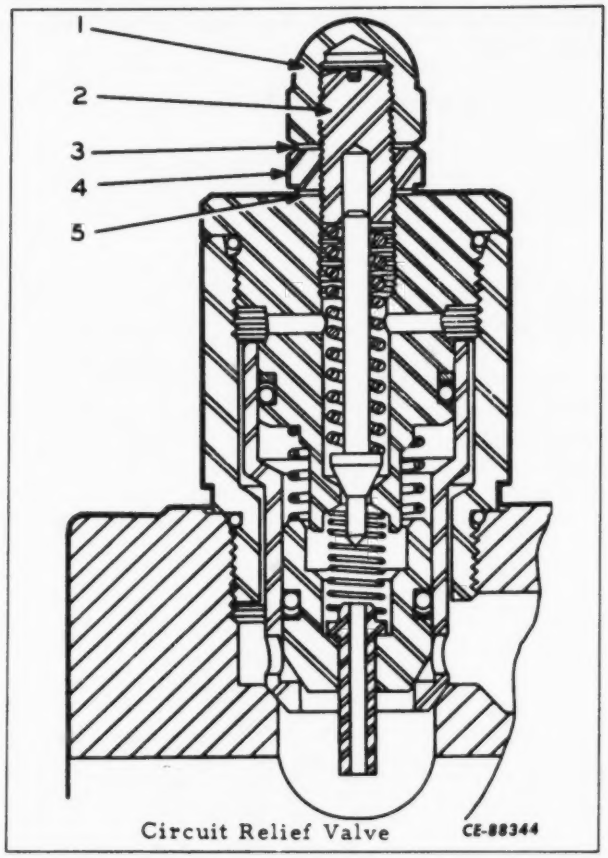


Figure 11-65
Bucket Relief Valve.

1. Acorn nut.
2. Adjusting screw.
3. Copper washer.
4. Jam nut.
5. Copper washer.

procedure until recommended setting is obtained.

i. When correct adjustment is obtained, hold adjusting screw (2) and tighten lock nut (4). Be sure copper washer (3) is in good condition and install acorn nut (1).

j. To test opposite valve, place bucket cutting edge under a very heavy object and slowly "Raise" boom while bucket remains in "Hold"

(Continued on next page)

## PRESSURE CHECKS AND ADJUSTMENTS - Continued

### BUCKET CIRCUIT RELIEF VALVES - Continued

position. Note pressure at which valve discharges. This pressure should equal recommended pressure. Refer to "SYSTEM PRESSURES" for recommended setting.

k. If adjustment is required, follow procedure in step "h." When correct adjustment is obtained, hold adjusting screw (2) and tighten lock nut (4). Be sure copper washer (3) is in good condition and install acorn nut (1).

l. Stop the engine. Relieve pressure in system by moving loader controls through their full travel several times. Relieve reservoir pressure by slowly removing filler cap. Remove 5000 psi gauges and "tees" and reconnect loader hydraulic lines. Check level of hydraulic system and add fluid as required.

### STEERING CONTROL RELIEF VALVE

Adjust relief valve as follows:

a. Remove pipe plug from tee at rear end of left hand steering cylinder and install a test gauge (5000 psi capacity).

◆ CAUTION: BEFORE ATTEMPTING TO ADJUST PRESSURE RELIEF VALVE, ALIGN FRAME HALVES AND INSTALL TRACTOR SAFETY BAR IN STRAIGHT AHEAD POSITION.

b. Start engine and allow it to run until hydraulic fluid reaches operating temperature.

c. With engine at low speed, turn steering wheel to left until all slack is taken up. Accelerate engine to full throttle and read pressure indicated on test gauge.

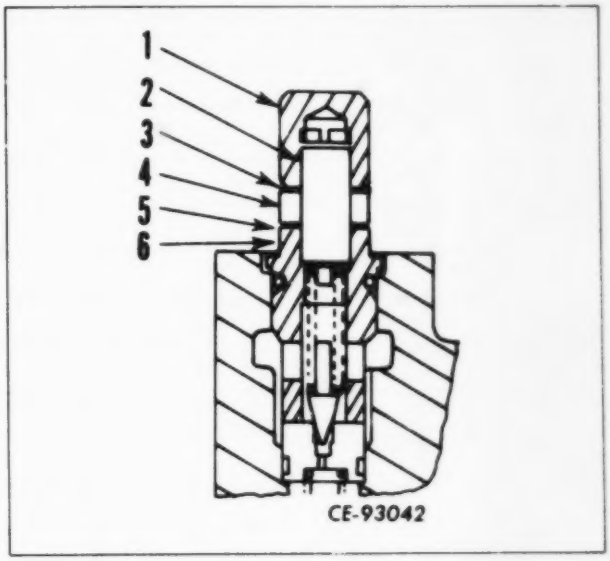


Figure 11-66

d. Idle the engine. If indicated pressure was not within recommended limits, adjustment is necessary. Refer to "SYSTEM PRESSURES" for recommended setting.

e. Remove acorn nut (1, Fig. 11-66) from adjusting screw (2). It will be necessary to hold jam nut (4) while removing acorn nut.

f. Hold adjusting screw (2) and loosen jam nut (4). To adjust pressure, hold jam nut and rotate adjusting screw clockwise to increase and counterclockwise to decrease pressure. Recheck indicated pressure. When correct pressure is obtained, hold adjusting screw and tighten jam nut.

g. Be sure washer (3) is in good condition and install acorn nut.

h. Stop the engine. Remove test gauge and replace pipe plug. Remove safety bar.



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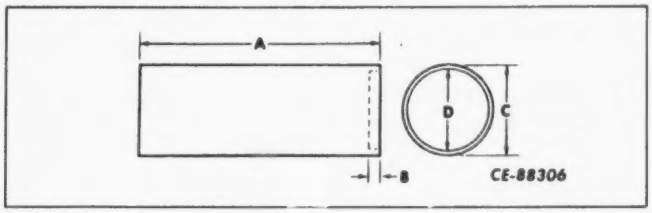
## SPECIAL TOOLS

SEAL INSTALLATION TOOL




SEAL INSTALLATION TOOL

| PUMP SERIES | LENGTH A (IN) | UNDERCUT B (IN) | O. D. C (IN) | I. D. D (IN) |
|---|---|---|---|---|
| 35V | 3-1/4 | 1/4 | 1-25/32 | 1-11/16 |
| 3525 | 3-1/4 | 1/4 | 1-25/32 | 1-11/16 |

Figure 11-67

# HYDRAULIC SYSTEM

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

# SECTION XII
# ELECTRICAL SYSTEM

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SECTION XII ELECTRICAL SYSTEM


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## DESCRIPTION OF SYSTEM

The electrical circuit employed in the H-100C series tractor is a 24 volt, negative ground system. Electrical energy stored in the batteries is available upon demand to the system components. These components, which include the instruments, headlights, back-up lights, stop and tail lights and cranking motor, are dependent upon battery energy until the engine drives the generator at a speed sufficient to carry the electrical load. Above this predetermined speed, electrical energy produced by the AC Generator supplies the normal demands of the system. A portion of this energy is sent to the batteries to keep them in a state of full charge.

A regulator is installed in the system to control the output of the generator. By using a regulated control, electrical energy produced by the generator is supplied to the system components on demand.

Four heavy duty six volt batteries, wired in series produce a 24 volt system. Two batteries are housed in each of the battery boxes located on the left and right hand side of the rear main frame. Hinged tops on the battery boxes provide easy access for servicing.

The system may be divided into two circuits; the cranking circuit, in use during engine starting and the charging circuit, supplying current to the remainder of the system when the engine is operating. In addition, the charging circuit replaces electrical energy drained from the batteries.

## PRECAUTIONS

NOTE: Since the AC generator and regulator are designed for use on only one polarity system, the following precautions must be observed when working on the charging circuit. Failure to observe these precautions will result in serious damage to the electrical equipment.

a. When installing a battery, always be absolutely sure the ground polarity of the battery and the ground polarity of the AC generator are the same.

b. When connecting a booster battery, be certain to connect the negative battery terminals together and the positive battery terminals together.

c. When connecting a charger to the battery, connect the charger positive lead to the battery positive terminal and the charger negative lead to the battery negative terminal.

d. Never operate the AC generator on open circuit. Be absolutely certain all connections in the circuit are secure.

e. Do not short across or ground any of the terminals on the AC generator or regulator.

f. Do not attempt to polarize the AC generator.

g. Disconnect the battery ground wire before welding on any part of the tractor.

# ELECTRICAL SYSTEM

## DESCRIPTION OF SYSTEM

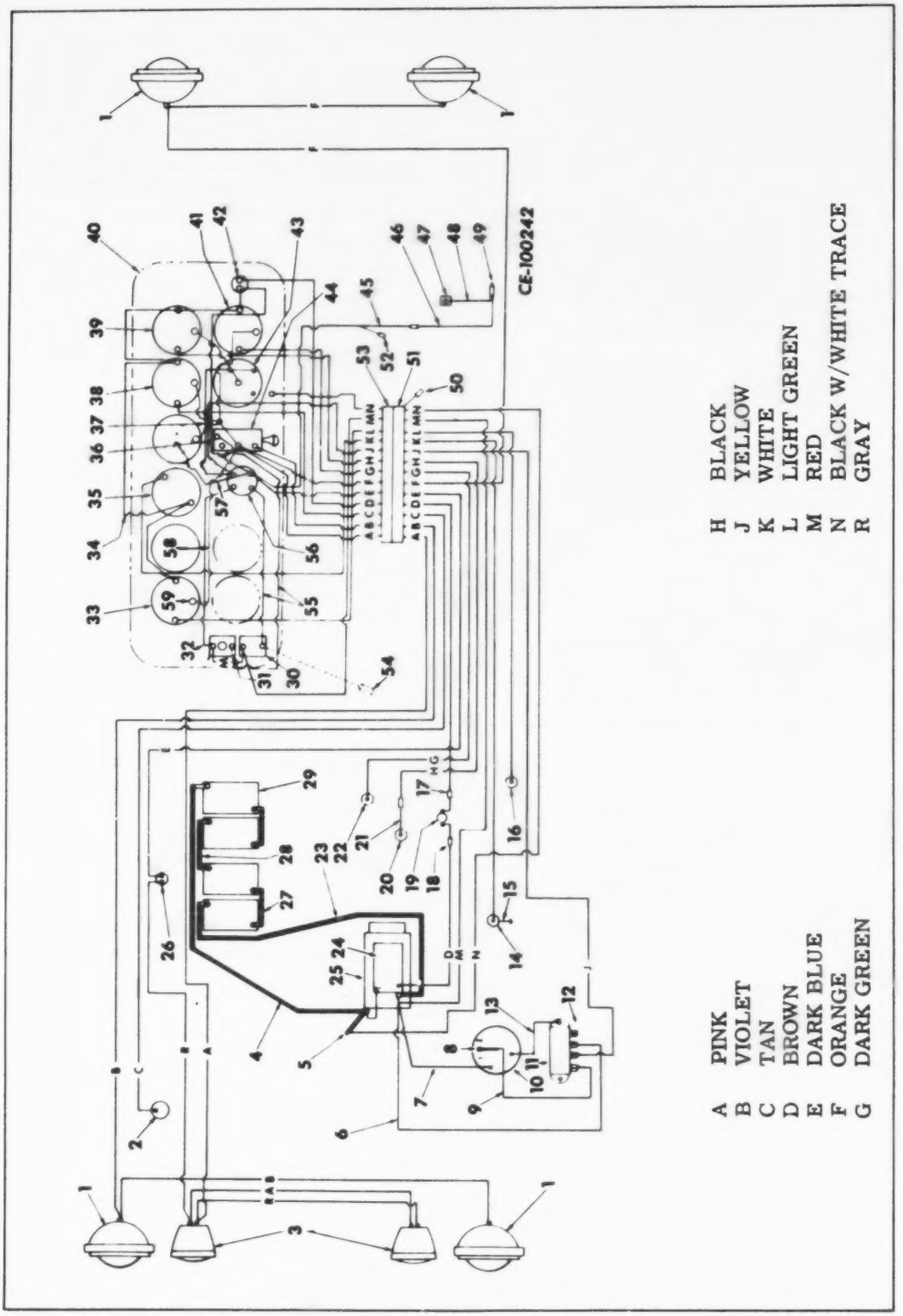


Figure 12-1
Wiring Diagram - I.H. Diesel Engine.

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Legend for Figure 12-1

1. Driving lights.
2. Fuel sender.
3. Stop and tail lights.
4. Battery ground cable.
5. Starter ground cable.
6. Wire.
7. Wire.
8. Lock connector.
9. Wire.
10. A. C. Generator.
11. Voltage regulator.
12. Lock connector.
13. Ground wire.
14. Hourmeter switch (when used).
15. Wire.
16. Torque converter temperature sender.
17. Cable.
18. Connector.
19. Neutral safety switch.
20. Oil pressure sender (engine).
21. Wire.
22. Water temperature sender.
23. Cable.
24. Starter solenoid.
25. Starting motor.
26. Stop light switch.
27. Jumper cable.
28. Jumper cable.
29. Batteries.
30. Circuit breaker.
31. Circuit breaker.
32. Jumper wire.
33. Torque converter temperature gauge.
34. Instrument jumper.
35. Hourmeter (when used).
36. Wire.
37. Wire.
38. Fuel gauge.
39. Engine oil pressure gauge.
40. Instrument panel.
41. Water temperature gauge.
42. Starter switch.
43. Voltmeter.
44. Light switch.
45. Cable.
46. Cable.
47. Parking brake warning light.
48. Cable.
49. Parking brake switch.
50. Not used (taped back).
51. Engine wiring harness.
52. Heater wire (when used).
53. Instrument harness.
54. Wire (shift modulator).
55. Wire.
56. Ignition switch.
57. Wire.
58. Gauge lights harness.
59. Gauge lamp.

# ELECTRICAL SYSTEM

## DESCRIPTION OF SYSTEM

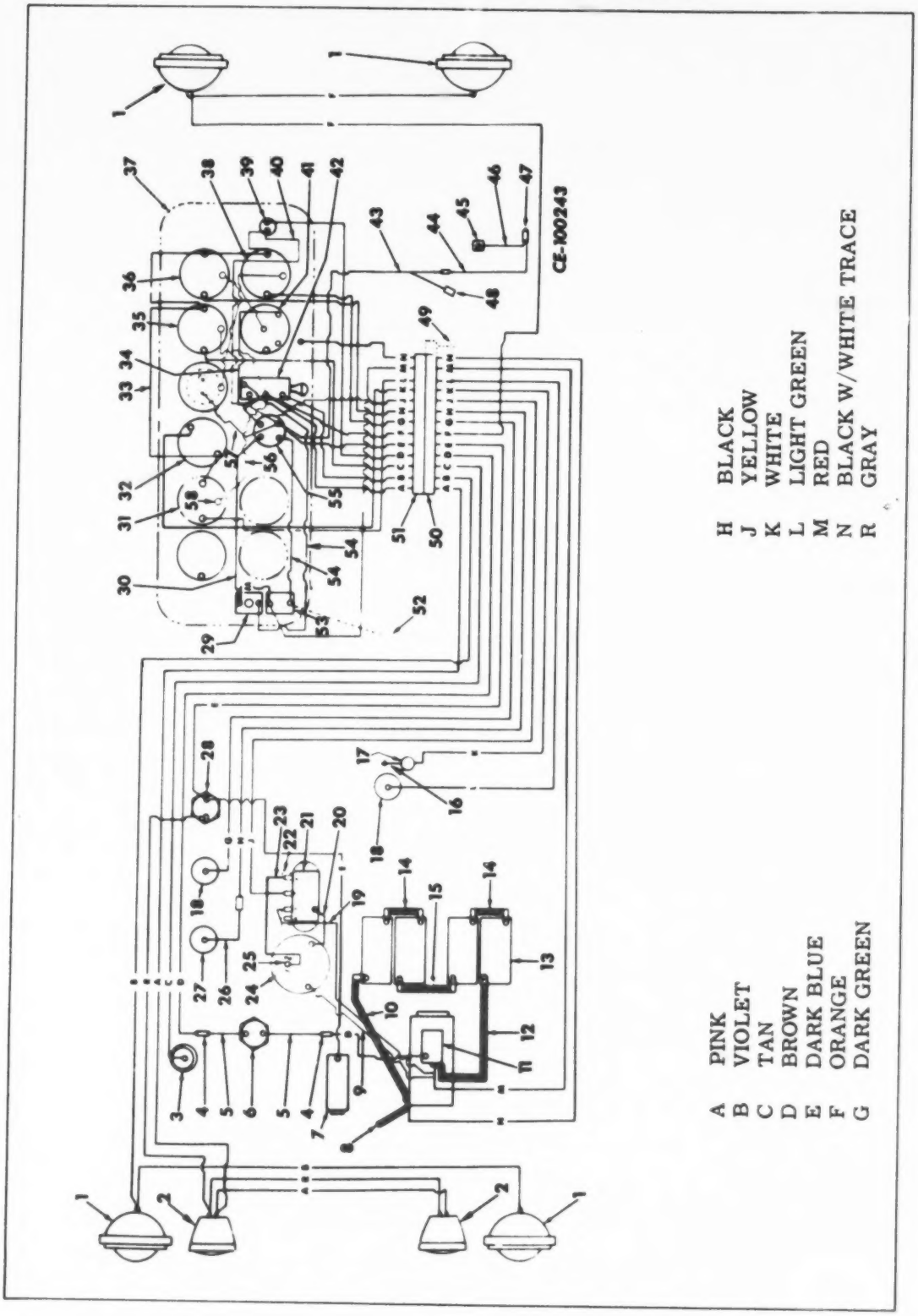


Figure 12-2
Wiring Diagram - Cummins Diesel.

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Legend for Figure 12-2

1. Driving lights.
2. Stop and tail lights.
3. Fuel sender.
4. Connector.
5. Cable (neutral safety switch).
6. Neutral safety switch.
7. Fuel solenoid.
8. Starter ground cable.
9. Wire.
10. Battery ground cable.
11. Starting motor.
12. Cable, battery to starter.
13. Batteries.
14. Jumper cable.
15. Jumper cable.
16. Hourmeter ground (when used).
17. Hourmeter switch (when used).
18. Water temperature sender.
19. Wire.
20. A. C. Generator ground cable.
21. Regulator.
22. Lock connector.
23. Wire.
24. A. C. Generator.
25. Lock connector.
26. Cable.
27. Engine oil pressure sender.
28. Stop light switch.
29. Circuit breaker.
30. Jumper wire.
31. Torque converter temperature gauge.
32. Hourmeter (when used).
33. Jumper wire.
34. Wire.
35. Fuel gauge.
36. Engine oil pressure gauge.
37. Instrument panel.
38. Water temperature gauge.
39. Starter push-button switch.
40. Wire.
41. Voltmeter.
42. Light switch.
43. Wire.
44. Wire.
45. Parking brake warning light.
46. Wire.
47. Parking brake switch.
48. Heater wire (when used).
49. Taped back - not used.
50. Main wiring harness.
51. Instrument harness.
52. Wire (shift modulator).
53. Circuit breaker.
54. Wire.
55. Ignition switch.
56. Gauge harness.
57. Wire.
58. Gauge lamp.

## BATTERIES

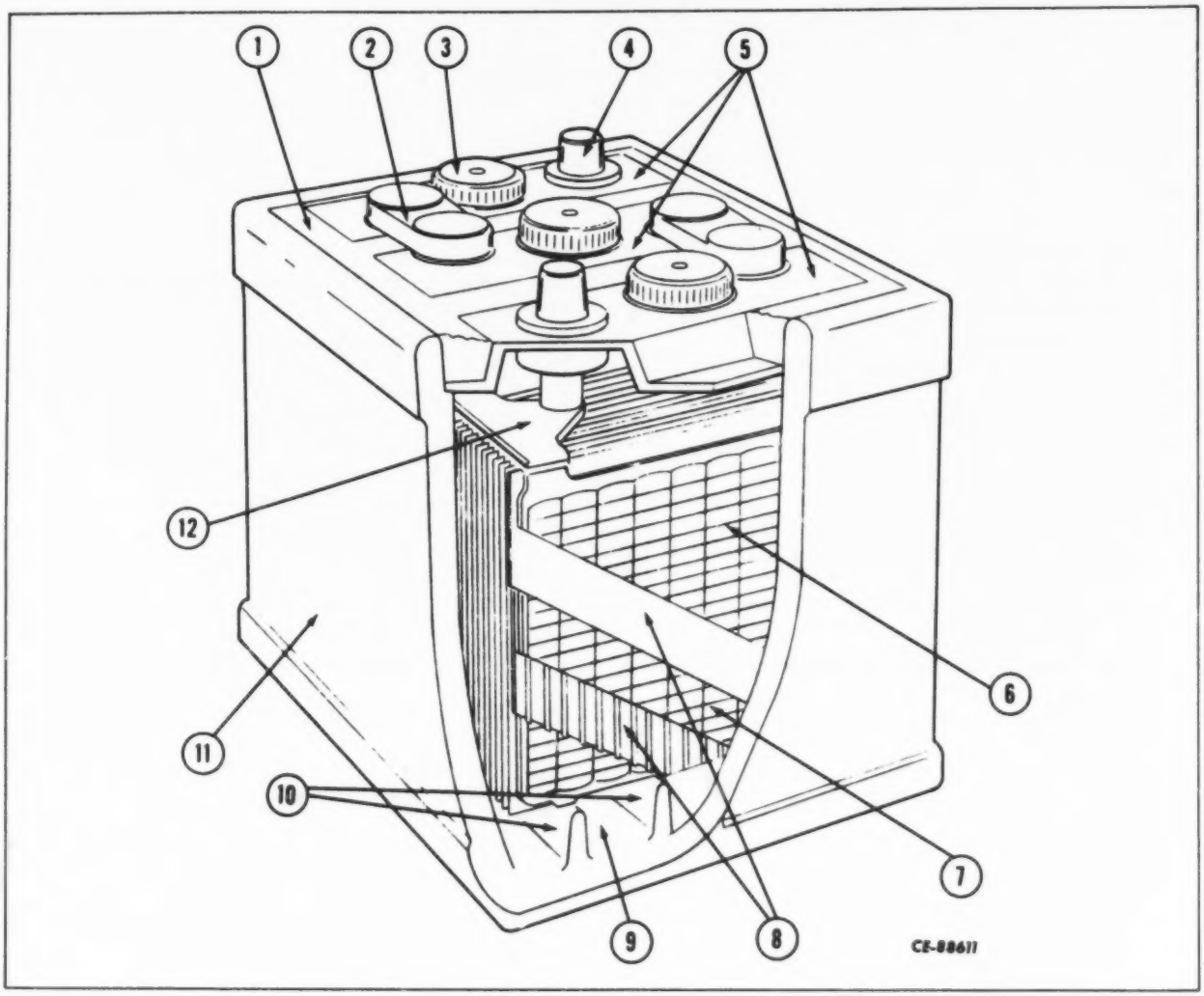


Figure 12-3
Typical 6 Volt Storage Battery.

1. Sealing compound.
2. Cell connector.
3. Vent plug.
4. Terminal post.
5. Cell covers.
6. Negative plate.
7. Positive plate.
8. Separators.
9. Sediment space.
10. Element rests.
11. Case.
12. Plate strap casting.

### DESCRIPTION

A lead-acid storage battery of the type used in the electrical system of the tractor, contrary to popular belief, does not store electricity. The hard rubber case stores the chemical ingredients necessary to produce electrical energy. This energy is produced only when a circuit to which the battery is connected is completed. During periods of inactivity, when no electrical energy is being supplied, a slow chemical breakdown or discharge is taking place. If the period of idleness is of sufficient length a condition known as a permanent sulfation will develop. Once permanently sulfated, a battery cannot be restored to its normal maximum capacity. Routine battery service greatly extends the useful life of the battery.

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## BATTERIES

### OPERATION

A six volt battery is composed of one large case (Fig. 12-4) divided into three equal compartments called cells.

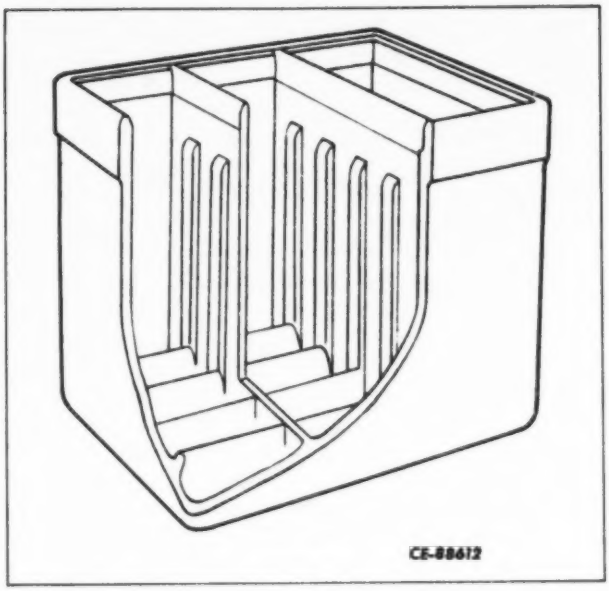


Figure 12-4
Battery Case.

Within each cell are a series of plates (Fig. 12-5) containing the active chemical material used in producing the electrical energy. The plates are immersed in a fluid called electrolyte. The plate frame is a grid design and the active material is attached by a process of pasting and bonding. Depending upon the material attached to the grid, some plates are classed as negative plates while the others are considered positive plates. Within each cell these plates are alternately spaced with each group being connected to its own common post strap, (Fig. 12-6) that is, one negative and one positive post strap per cell.

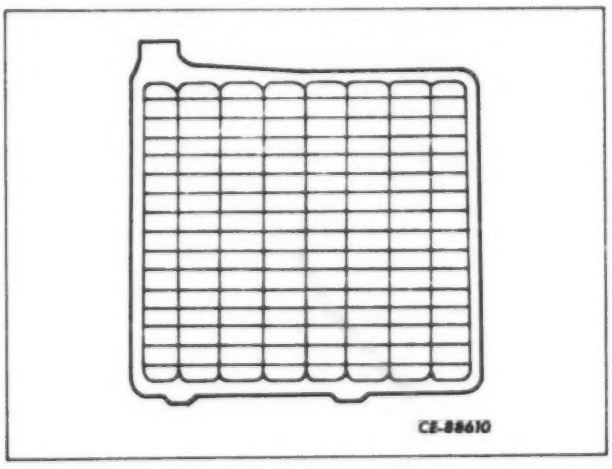


Figure 12-5
Battery Plate.

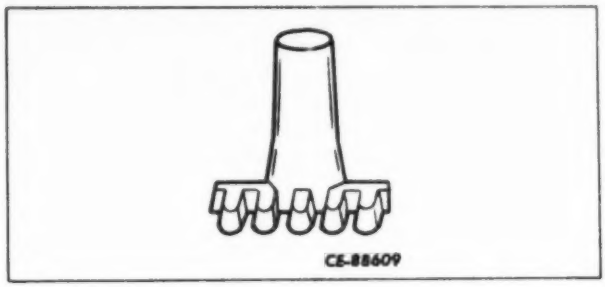


Figure 12-6
Post Strap.

Plates are kept from touching one another by sheets of insulating material called separators. Separator material ranges from cellulose fiber to rubber and plastics with the best materials being used in the top quality batteries. The ribs on the separator plates (Fig. 12-7) always face the positive plates to provide a greater acid volume at this point with resulting improved efficiency.

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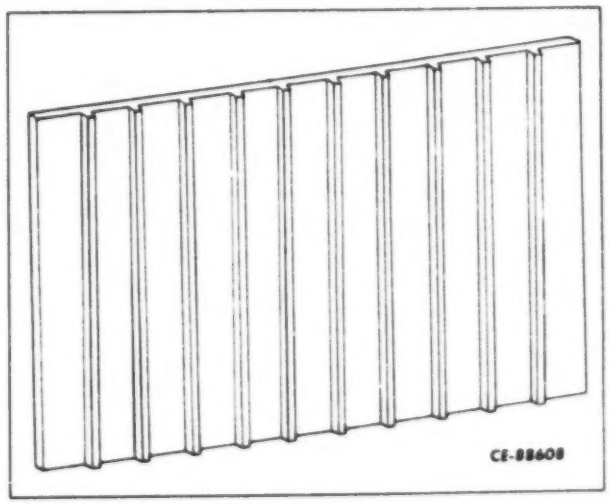



Figure 12-7
Separator Plate.

## OPERATION - Continued

In addition to insulating one plate from the other, the separator must be porous enough to permit rapid electrolytic action. This action is the energy producing chemical process that takes place between the negative and positive plates, using the electrolyte in which the plates are immersed as a conductor. This electrolyte is basically a sulphuric acid and water solution. Each cell is capable of producing two volts.

Cell cover construction is primarily of moulded hard rubber, providing an acid tight seal through the use of moulded bushings for the two terminal posts and intermediate connections that protrude through the cover. The covers (Fig. 12-8) are also provided with vent openings of various construction.

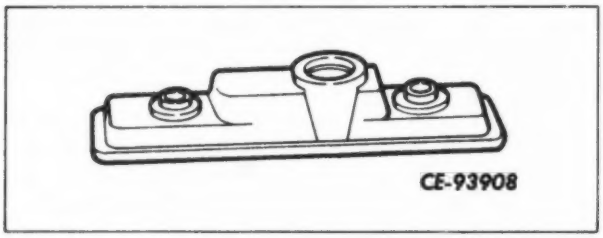



Figure 12-8
Cell Cover.

Battery covers (Fig. 12-9) provide cell covers in a one piece unit. The covers are sealed on after all intercell connections are made. Vent plugs are an important part of cover construction.

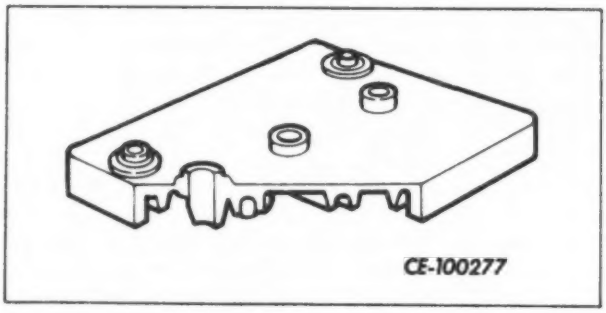



Figure 12-9
Battery Cover.

The cells are joined by heavy metal straps called cell connectors (Fig. 12-10). The positive plates of one cell are connected to the negative plates of the adjoining cell and so on. With three cells connected in series, a battery capable of producing six volts is created. If the battery is connected into a complete electrical circuit, a chemical reaction between the active plate material and the electrolyte causes a flow of electrical current.

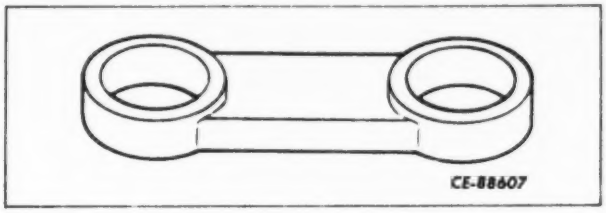



Figure 12-10
Cell Connector.

The products of the positive active material and the electrolyte are lead sulfate and water. While the lead sulfate is being deposited on the positive plate the electrolyte is being transformed into water.

The negative active material and electrolyte produce only lead sulfate which builds up on the negative plate.

As lead sulfate continues to build up on the plates it reaches a point where the chemical reaction stops. At this point the battery is considered discharged.

As the battery is charged a reverse chemical action takes place and the built up lead sulfate is converted back to active material as the water is transformed into its original capacity, electrolyte.

During normal cycling the battery loses vaporized water through the vent caps. This water must be replaced before the electrolyte solution falls below the tops of the plates. If the plates are exposed the active material dries and hardens and becomes permanently sulfated. Once permanently sulfated the area may not be reactivated again.

## BATTERIES

### SERVICE

Close adherence to a regular service schedule will greatly extend the useful life of the battery. Battery service should cover the following:

a. Electrolyte Level - Check the level of the solution after battery cap removal. Fill to level indicated on battery cap or until plates are covered. Do not overfill. Overfilling results in loss of electrolyte and excessive corrosion around battery. Use fresh distilled water or water approved by the battery manufacturer.

b. Cables - Check cables for defects and/or corrosion. Replace badly corroded cables. Remove corrosion from terminals, cables, battery top, hold-down and battery box with a diluted ammonia or soda solution. Rinse with clean water. Terminals may be cleaned with a wire terminal cleaning brush. Coat terminals and cable clamps with a light coat of petroleum jelly. Tighten cable clamps securely.

c. Visual Inspection - Inspect the battery case exterior for cracks or leaking electrolyte solution. Check top for cracked or missing sealing compound. Be sure battery hold-down is snug. Do not overtighten hold-down as this may result in distorting and cracking the battery case.

In addition to the above service procedures the specific gravity of the electrolyte should be checked to observe the battery state of charge. A battery hydrometer is used to check specific gravity. Use a hydrometer equipped with a thermometer, drawing the electrolyte into the tube and expelling it several times to stabilize the temperature. To obtain an accurate reading the hydrometer must be held so that the eye is on a level with the liquid surface. Draw just enough electrolyte into the hydrometer to allow the glass float to float freely in the tube. The float must not touch the top, bottom or side of the tube.

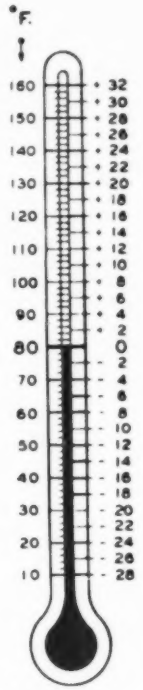
The temperature of the electrolyte has a definite effect on the specific gravity reading. To compensate for each 10° F. change above 80° F. add four (.004) gravity points. For each 10° F. drop below 80° F. subtract four (.004) gravity points.

| | | |
|---|---|---|
| 1.260 Sp. Gr. | 1.280 Sp. Gr. | 100% Charged |
| 1.230 Sp. Gr. | 1.250 Sp. Gr. | 75% Charged |
| 1.200 Sp. Gr. | 1.220 Sp. Gr. | 50% Charged |
| 1.170 Sp. Gr. | 1.190 Sp. Gr. | 25% Charged |
| 1.140 Sp. Gr. | 1.160 Sp. Gr. | Very little useful capacity |
| 1.110 Sp. Gr. | 1.130 Sp. Gr. | Discharged |

CE-88606

Figure 12-11
State of Charge Scale.

For example; a specific gravity reading of 1.235 at an indicated electrolyte temperature of 100° F. would have an actual value of 1.243 (1.235 + .008 = 1.243). A specific gravity reading of 1.250 at an indicated electrolyte temperature of 20° F. would have an equal value of 1.226 (1.250 - .024 = 1.226).




**EXAMPLE No. 1 —**
**Temperature *above* 80°F.**
**Hydrometer Reading 1.235**
**Acid Temperature 100°F.**
***Add* .008 Sp. Gr.**
**Corrected Sp. Gr. is 1.243**

**EXAMPLE No. 2 —**
**Temperature *below* 80°F.**
**Hydrometer Reading 1.250**
**Acid Temperature 20°F.**
***Subtract* .024 Sp. Gr.**
**Corrected Sp. Gr. is 1.226**

CE-88605

Figure 12-12
Temperature Correction Scale.

## BATTERY CHARGING

Fast Charging - In this method current is fed to the battery at a greatly accelerated rate. The charging period is comparatively short in order to bring the battery up to a state of charge before the temperature of the electrolyte becomes excessive. Temperatures above 125° F. must be reduced by stopping the charging process or reducing the rate.

This "quick charge" method will not completely charge a battery. An additional slow charge must be used to bring the battery up to maximum capacity.

Slow Charge - This method is a complete reversal of the fast charge. A small amount of current is supplied for periods up to 24 hours.

Charging Safety - A product of the battery charging operation is an explosive gas escaping from the vent hole in each battery cap. A portion of this gas remains in the area beneath each cell cover. Although this condition is normal, certain safety precautions must be observed to prevent ignition and resultant explosion.

a. Do not smoke near charging or recently charged batteries.

b. Do not pull the charging leads from the battery terminals while the charger is in operation. Sparks occurring at the terminals can ignite the gas. Turn off the charger before disconnecting the leads.

In addition, never fast charge a frozen battery. Thaw the electrolyte solution at room temperature before attaching the charger. Check the battery case for cracks.

Before recharging a battery, regardless of the method used, the electrolyte must be brought up to the recommended level.

Figure 12-13

## ALTERNATING CURRENT GENERATOR

### DESCRIPTION AND OPERATION

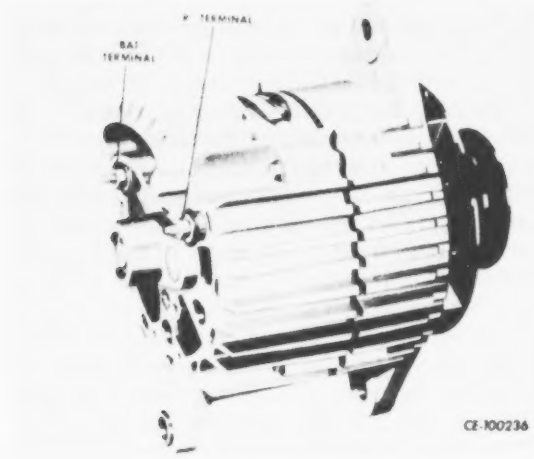



Figure 12-14
Typical Diode Rectified AC Generator.

The AC generator (sometimes called an alternator) is an electrical energy producing unit designed to meet the increased demand for electrical energy during low speed operation or at engine idle operation. It is also designed to give long periods of service with a minimum of maintenance. The rotor is mounted on a ball bearing at the drive end and a roller bearing at the slip ring end. Each bearing has a grease supply which eliminates the need for periodic lubrication. Two brushes are used to carry current through the two slip rings to the field coil which is mounted on the rotor. Brushes are extra long and under normal operating conditions will provide long service.

Stator windings are assembled on the inside of a laminated core that forms part of the AC generator frame. Six rectifier diodes are mounted in the slip ring end frame and are connected to the stator windings. On the AC generator the diodes change AC voltages to DC voltage available at the "BAT" terminal on the generator.

An external view of the diode rectified AC generator is shown in Fig. 12-14. A cross sectional view giving internal details is illustrated in Fig. 12-15.

(Continued on next page)

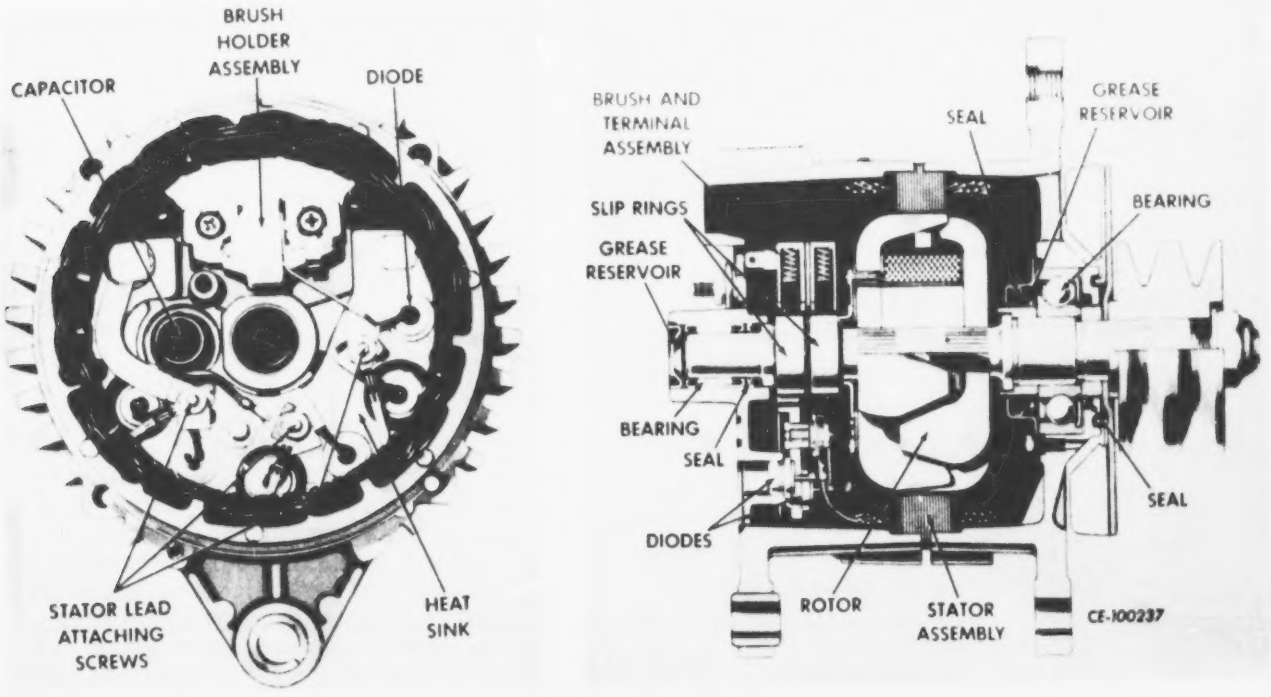



Figure 12-15
Diode Rectified Alternating Current Generator - Cross Sectional Views.

## ALTERNATING CURRENT GENERATOR

### DESCRIPTION AND OPERATION - Continued

From the description given above, it is obvious that the make up of this unit is different from the conventional DC generator. A comparison is made between the AC and DC type generator in the following steps:

a. The AC generator has but one field coil and this is located on the rotor shaft. In the DC generator there may be two or more field coils and these are attached to the generator frame. Note this big difference: The AC generator field coil rotates while the DC generator field coils are stationary.

b. The stationary or "stator" windings in the AC generator are attached to the generator frame and carry output current. They perform the same function as the rotating windings in the armature of a DC generator.

c. The brushes in the AC generator are connected in series with the field coil and carry only a low field current. In the DC generator the brushes are connected through the commutator to the armature windings and carry the total generator output. Since low current is carried by the brushes in the AC generator, their life is greatly improved over those in the conventional DC unit.

REGULATORS: To prevent the AC generator from producing too much voltage and thus burning out the accessories and overcharging the battery, its voltage must be limited. For this function a regulator is necessary in the charging system (Fig. 12-16). While the

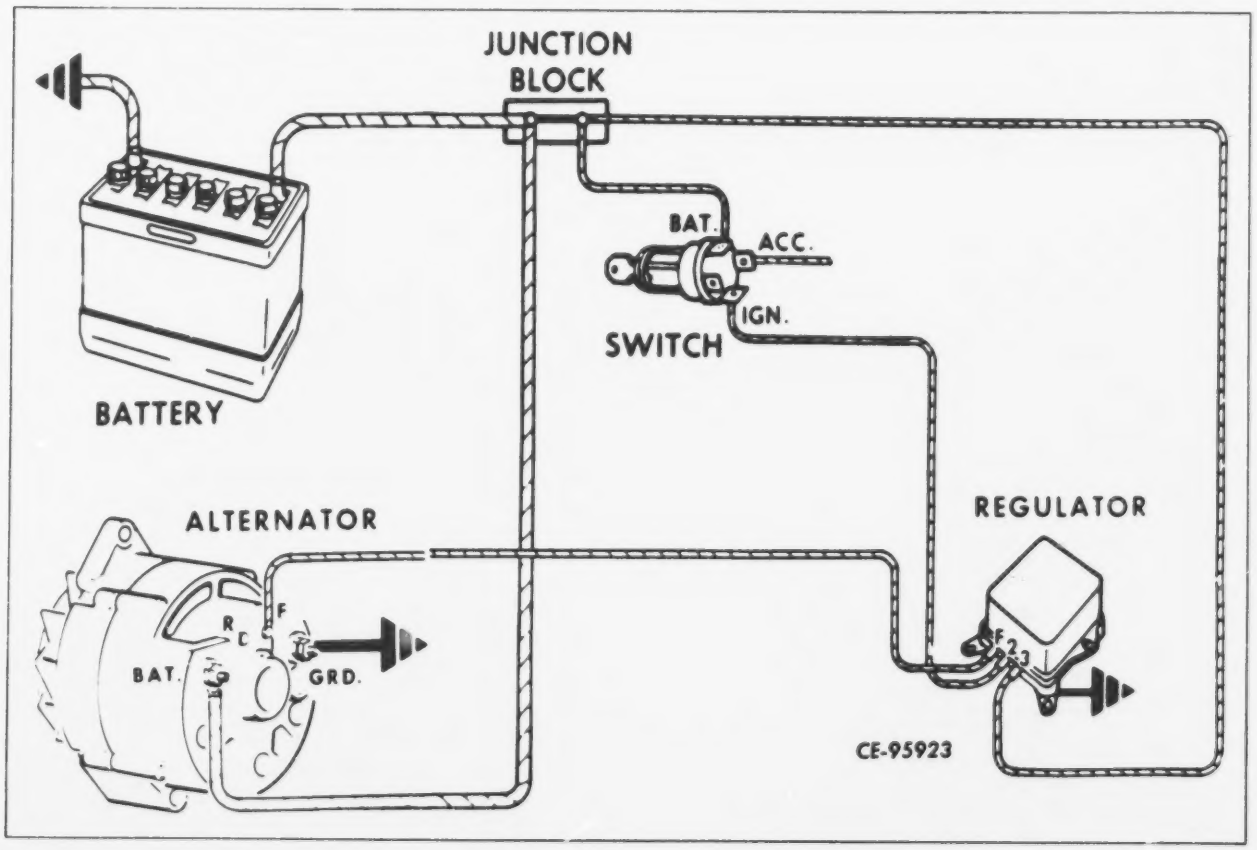



Figure 12-16
Typical Charging System.

## ALTERNATING CURRENT GENERATOR

regulator for an AC generator performs the same function as does the regulator for a DC generator, there are also differences in its make up. These are covered in this section under "REGULATOR."

The AC generator uses the same basic principles of electricity and magnetism that makes the DC generator possible. When a current is passed through a wire, a magnetic field is created around the wire. By bending the wire into a series of loops or coils a stronger magnetic field is produced. When an iron core is placed inside the coil and current is passed through the coil, an electromagnet is formed (Fig. 12-17).

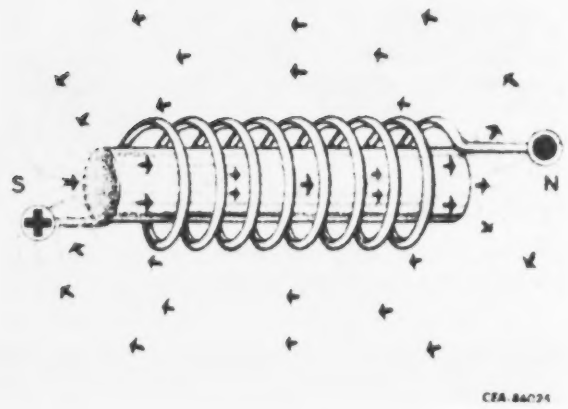



Figure 12-17
Principles of Magnetism.

This is the principle that is used in the design of the AC generator rotor. To form the rotor a wire is first wound around an iron spool which is then placed over the rotor shaft. The pole pieces or rotor segments are then placed around the field coil assembly. The connecting ends of the coil are fastened to the slip rings on the rotor to complete the assembly (Fig. 12-18).

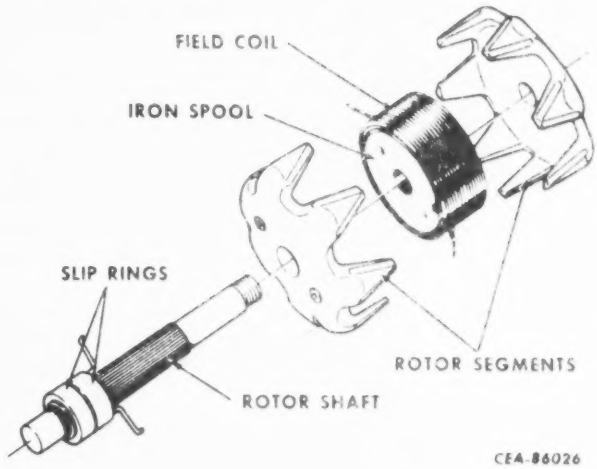



Figure 12-18
Components, AC Generator Rotor.

When battery current flows through the field coil on the rotor a strong electromagnet is formed with a North magnetic pole in each pole of one rotor segment and a South magnetic pole at each pole of the other segment. As the rotor turns, a spinning magnetic field is produced (Fig. 12-19).

(Continued on next page)

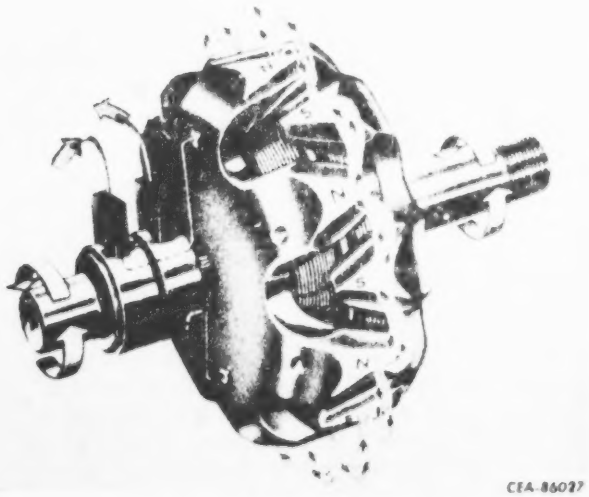



Figure 12-19
Magnetic Field Spinning with Rotor.

## ALTERNATING CURRENT GENERATOR

### DESCRIPTION AND OPERATION - Continued

#### STATOR

The stator or stationary winding in the AC generator is made up of many loops of wire (Fig. 12-20). As the alternate North and South poles of the revolving rotor pass each loop of the stator winding, a voltage and current output of a designed value is obtained.

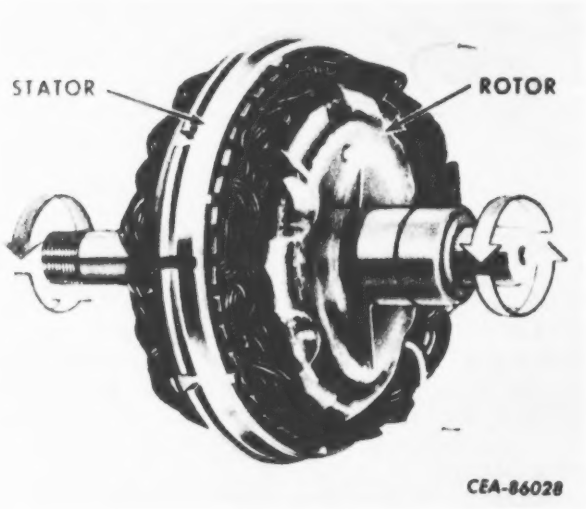



Figure 12-20
Rotor and Stator.

A simplified rotor and the most basic type of stator, which is a single loop of wire, is shown in Fig. 12-21. As the magnetic field from the spinning rotor cuts across this wire, an electrical pressure or voltage is produced in the wire loop. The faster the rotor turns, the greater the voltage. More loops in the stator winding also increases the voltage.

Since stator windings are influenced alternately by North and South poles of the spinning magnetic fields, an oscillating voltage is produced. This oscillating voltage causes the current in the stator windings to flow first in one direction and then the other. This type of flow is called "alternating current" or simply AC current. Similarly the voltage that produces this type of current is called an AC voltage.

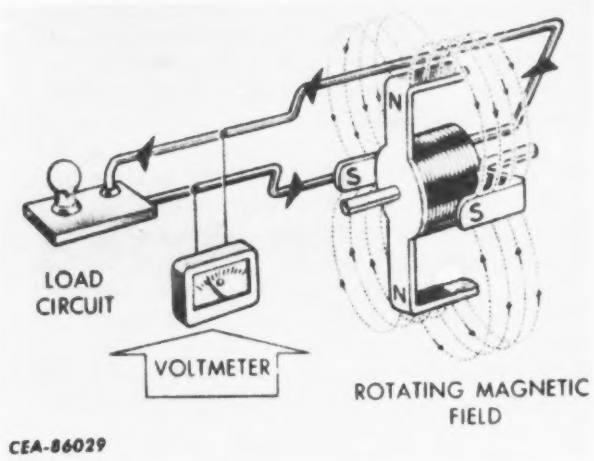



Figure 12-21
Simple AC Generator.

#### DIODES

The battery and other electrical accessories in the electrical system operate on direct current which flows in one direction only. For this reason it is necessary to change the AC current to DC current. This function is performed by rectifying diodes (Fig. 12-22).

A diode is an electrical device which changes or rectifies alternating current (AC) to direct

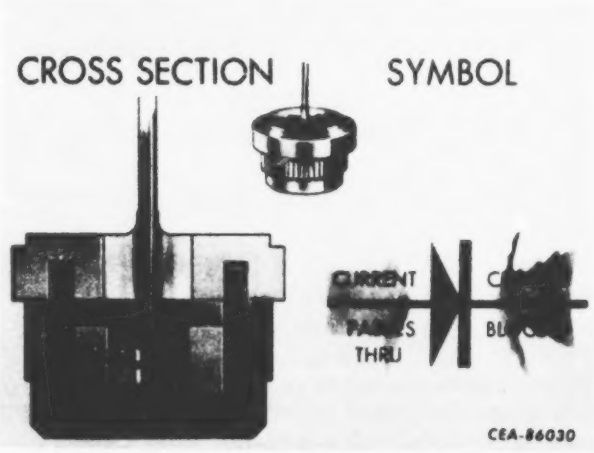



Figure 12-22
Cross Section of Rectifying Diode.

## ALTERNATING CURRENT GENERATOR

current (DC) by allowing current to pass through it freely in one direction but not in the other. It thus acts much like an electrical check valve or the commutator on a DC generator.

The six diodes (three positive and three negative) (Fig. 12-23) are mounted in the end frame of the AC generator. These diodes change the AC current from the stator windings to a flow of DC current which will be available at the output terminal of the AC generator.

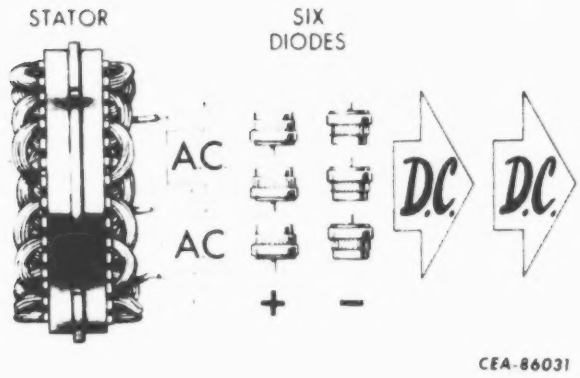



Figure 12-23
Function of Diode in the AC Generator.

### HEAT SINK

The heat sink, as its name implies, provides for dissipation of heat which is built up around the diodes while the AC generator is operating.

### CAPACITOR (CONDENSER)

The capacitor mounted in the end frame serves two purposes. First it limits the transient voltage across the diodes thereby protecting them from damaging charges. Second it provides radio interference suppression.

### SERVICE

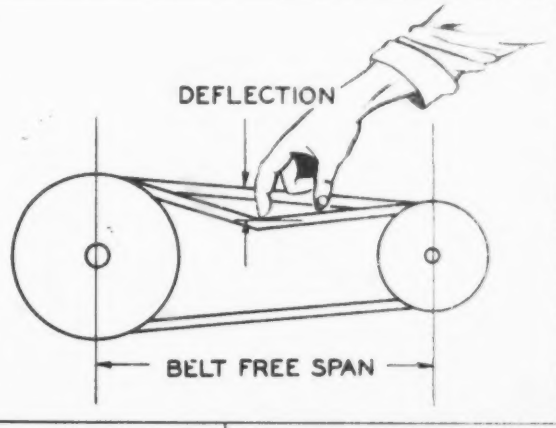
DRIVE BELT TENSION - Neglect or improper care of the alternator drive belt may result in undercharged batteries, short belt life and/or worn bearings. Overly tight belts place an additional strain on pulleys, bearings and the belts themselves. Loose belts slip, overheat and wear rapidly.

Check belt tension by depressing belt midway between drive and driven pulleys (Fig. 12-24). Extend the index finger straight down against the belt.

Replace frayed belts. Do not pry or roll belts onto pulleys. Use the adjusting mechanism provided. Relieve belt tension if the machine will be idle for a period in excess of one month.

Clean belts by wiping them off with hydraulic brake fluid. This will eliminate belt squeak.

OVERHAUL - For overhaul information and/or service contact your Delco-Remy distributor.




| BELT WIDTH | DEFLECTION PER FOOT OF SPAN |
|---|---|
| 1/2 in. | 3/8 in. |
| 11/16 in. | 13/32 in. |
| 3/4 in. | 7/16 in. |
| 7/8 in. | 1/2 in. |
| 1 in. | 9/16 in. |

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Figure 12-24

## REGULATOR

### DESCRIPTION AND OPERATION

A typical double contact regulator is shown in Fig. 12-25. This regulator has four terminals.

The terminals are of the slip-connection type, and a special connector body on the vehicle wiring harness is keyed to mating slots in the regulator base to insure proper connections. Also, a projection on the connector body serves to latch the assembly together. This prevents disconnections due to vibration. The assembly can be disconnected by lifting the latch slightly, (Fig. 12-25).

A double contact voltage regulator unit and a field relay unit make up the regulator assembly. The voltage regulator unit operates to limit generator voltage to a pre-set value, whereas the field relay connects generator field winding and regulator winding directly to the battery.

Figure 12-25
Typical Two-Unit Regulator.

This model regulator is designed for use on only one polarity system. Note the marking on the regulator base, or refer to specifications to determine if polarity of the regulator is negative or positive.

IMPORTANT: On electrical systems using these regulators, the polarity of the regulator, generator and battery must be the same. When installing any one of these three units, do not make any connections without first checking polarities.

A typical wiring diagram showing internal circuits of the regulator is shown in Fig. 12-26.

On some circuits, a condenser may be connected to the No. 4 regulator terminal. If a condenser is not used, neither is the No. 4 terminal.

NOTE: Do not connect anything to the No. 4 terminal other than a condenser.

Following is a brief description of the operating principles of the units in this type of circuit. When the switch is closed, the field relay winding in the regulator is connected directly to the battery. The magnetism created in the winding attracts the relay armature toward the core, causing the contacts to close. This connects the generator field winding directly to the battery, allowing field current to flow from the battery to the regulator No. 3 terminal, through the field relay contacts and then through the voltage regulator lower or series contacts. Current continues to flow to the regulator "F" terminal, and then through the generator field winding to ground.

When the generator begins to operate, AC voltages are generated in the stator windings, and these voltages are then changed or rectified to a DC voltage which appear at the "BAT" or output terminal on the generator.



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## REGULATOR

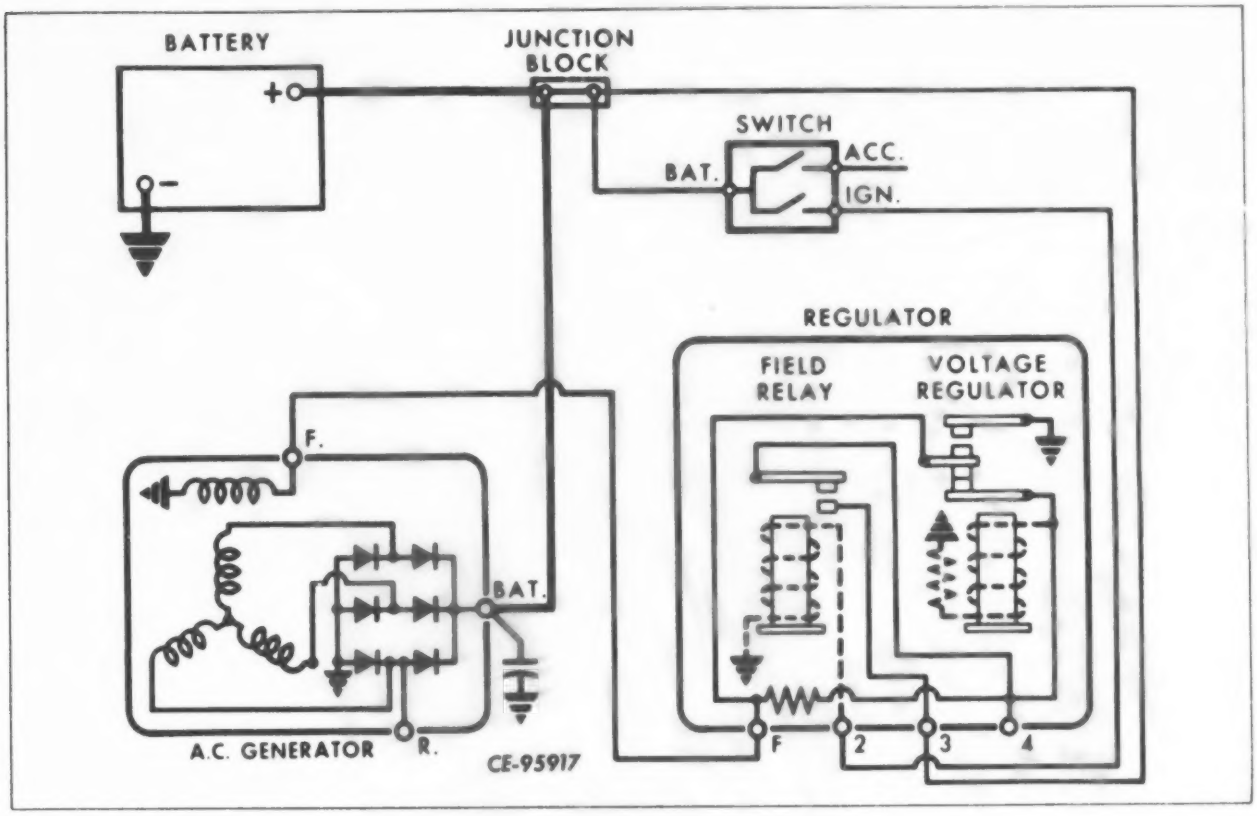


Figure 12-26
Typical Wiring Diagram Showing Internal Circuits.

As the speed of the generator increases, the voltage at the "BAT" terminal of the generator also increases. This impresses a higher voltage through the field relay contacts and across the voltage regulator shunt winding. The increased magnetism created by the higher voltage across the winding causes the lower contacts to separate, and field current then flows through a resistor resulting in reduced field current. This reduced field current causes the generator voltage to decrease, which decreases the magnetic pull of the voltage regulator shunt winding. The spring causes the contacts to reclose, and the cycle then repeats many times per second to limit the generator voltage to a pre-set value. As the generator speed increases even further, the resistor connected across the contacts is not of sufficiently high value to maintain voltage control on the series contacts. Therefore the voltage increases slightly causing the upper or shorting contacts to close. When this happens, the generator field winding is shorted and no current passes through the winding. With no current in the field winding, the generator voltage decreases, which also decreases the magnetism in the shunt winding and the upper or shorting contact points open. With these points open, field current flows through the resistor and the field winding. As the voltage increases, the contacts re-close. This cycle then repeats many times per second to limit the generator voltage to a pre-set value at high generator speeds. The voltage regulator unit thus operates to limit the value of generator voltage throughout the generator speed range. Consequently the electrical accessories are protected from too high voltage which would damage them.

## SERVICE

For service and/or overhaul information contact your local Delco-Remy distributor.

## CRANKING MOTOR

### DESCRIPTION

A simple description of the cranking motor, commonly referred to as the "starter," is an electric motor used to rotate the engine crankshaft during the starting procedure. In reality this is an oversimplified explanation. The cranking motor is an electric motor of a highly specialized design. It is capable of producing high horsepower and tremendous torque despite its small size. This high output is restricted to very short intervals; 30 seconds or less. During its periods of operation the motor is actually overloaded and if subjected to long periods of continuous operation will burn itself out.

One end of the cranking motor is fitted with a pinion gear to engage the engine flywheel and one of several different engagement mechanisms. Mounted on top of the motor housing is a heavy duty solenoid used to actuate the engaging mechanism. The ratio of the drive pinion to the flywheel ring gear is approximately 15 or 20 to 1; that is 20 teeth on the ring gear for each tooth on the pinion. This allows the cranking motor to operate at a high rpm and exert a considerable amount of torque.

### OPERATION

Current enters the cranking motor and passes through the field windings developing a magnetic field. The current then passes to the commutator brushes, commutator, and then through the armature windings, developing a second magnetic field. As the two strong magnetic fields oppose each other it causes the armature to rotate.

The cranking motor employed is equipped with an overrunning clutch drive mechanism. A solenoid is mounted on top of the motor housing. The solenoid plunger is connected to one end of a pivoting shift lever; the opposite end of the lever engages the drive pinion mechanism. The pinion mechanism uses a sprag type clutch to drive the pinion gear. A high amperage switch is located in the end of the solenoid opposite that from which the plunger rod projects.

When the solenoid is energized the plunger is drawn to the left (Fig. 12-27) pulling the upper end of the shift lever to the left. This forces the lower end of the lever to the right, moving the attached pinion assembly into the engage position. Both the spirally splined sleeve on which the pinion rides, and the bevels on the gear teeth allow the pinion to rotate during engagement. Should a butt tooth engagement occur, a pinion block prevents the closing of the contact points and resultant spinning meshes with the ring gear. A second try will engage the pinion.

As the solenoid plunger reaches the end of its stroke it activates the high amperage switch allowing battery current to flow into the cranking motor. As the cranking motor shaft begins to rotate, the sprags, by nature of their design, wedge themselves between their housing and the pinion spiral spline causing the pinion, spiral spline, sprag clutch and motor armature to rotate as a unit. The pinion, being in mesh with the flywheel ring gear, causes the engine crankshaft to rotate.

When the engine starts, it drives the pinion faster than the armature is rotating. This relieves the jamming action of the sprags and the pinion "freewheels" within the sprag housing. As the operator releases the starting switch, the solenoid is de-energized, allowing the return spring in the solenoid to move the plunger to the right (Fig. 12-27). When the plunger moves to the right the shift lever draws the pinion assembly from the engage position. At the same time the plunger movement to the right breaks the contact at the high amperage switch, stopping armature rotation.

### SERVICE

At 200 hour intervals the housing cover plates should be removed and accumulated dust and dirt blown out with a jet of compressed air. At the same time inspect the brushes to be sure they are in good condition and capable of another 200 hours of service.

For further service and overhaul information contact your local Delco-Remy distributor.

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## CRANKING MOTOR

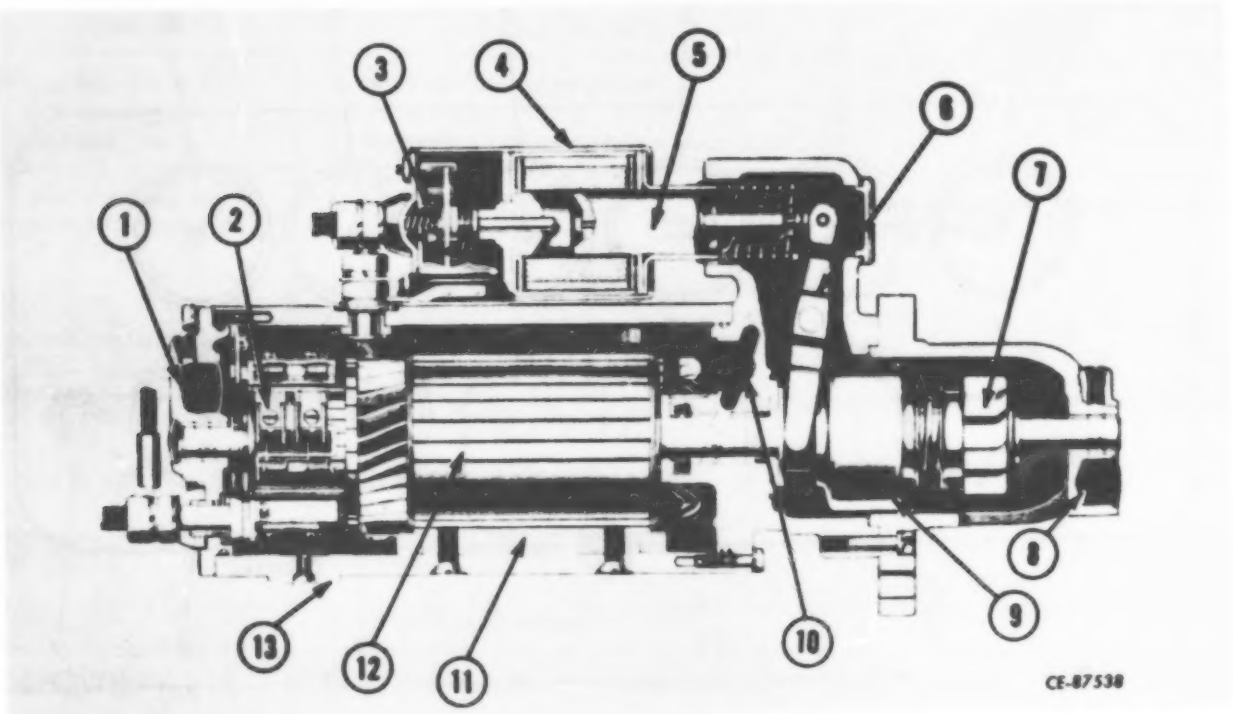


Figure 12-27
Diesel Engine Cranking Motor - Cross Section.

1. Oil reservoir.
2. Brushes.
3. High amperage switch.
4. Solenoid housing.
5. Solenoid plunger.
6. Pivoting shift lever.
7. Pinion gear.
8. Oil reservoir.
9. Sprag clutch.
10. Oil reservoir.
11. Field winding.
12. Armature.
13. Brush inspection plate.

## INSTRUMENTS

The instruments, housed in the panel and box assembly to the left of the operator are self explanatory. Each indicates the immediate condition of the system to which it is connected. With the exception of the fuel pressure gauge and the air pressure gauge, the units are all electrically operated. Due to the complex construction of each gauge and their relative low cost, repair parts for gauges are not offered. If a gauge is proven to be defective it should be replaced.

# ELECTRICAL SYSTEM

## INSTRUMENTS

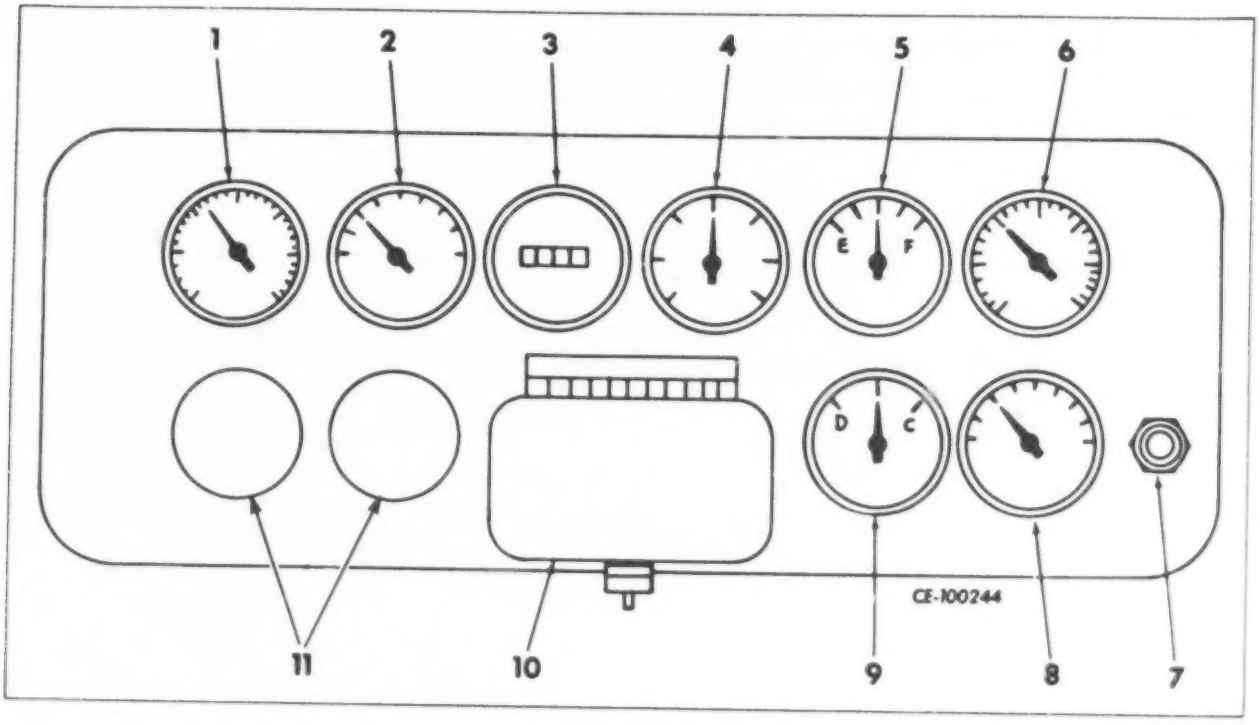


Figure 12-28
I.H. Diesel Instrument Panel.

1. Converter oil temperature.
2. Fuel pressure gauge.
3. Hourmeter.
4. Air pressure gauge.
5. Fuel.
6. Engine oil pressure.
7. Starter push button.
8. Engine temperature.
9. Voltmeter.
10. Light and ignition switches cover.
11. Plug button.

## TROUBLE SHOOTING

The electrical system, as previously mentioned, may be divided into two circuits, the cranking circuit and the charging circuit. To trouble-shoot the system, a primary analysis should be made to determine which circuit is at fault.

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Charge too low or no charge at all. | 1. Defective battery.<br>2. Slipping generator drive belt.<br>3. Defective generator.<br>4. Malfunctioning regulator. | |

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## TROUBLE SHOOTING

| COMPLAINT | PROBABLE CAUSE | REMARKS |
|---|---|---|
| Charge too high; overcharged battery. | 1. Malfunctioning regulator.<br>2. Incorrect pulley used on generator. | |
| Battery uses an excessive amount of water. | 1. Charging rate too high.<br>2. Incorrect pulley used on generator. | 1. Check and adjust or replace regulator. |
| Rapid burn out of light bulbs. | 1. Charging rate too high. | |
| Cranking motor operates slowly or not at all. | 1. Battery discharged.<br>2. Defective cranking motor.<br>3. Corroded, loose or defective cables.<br>4. Defective solenoid. | |
| Lights dim. | 1. Batteries low.<br>2. Poor ground.<br>3. Loose connections. | |
| One electrical gauge not operating. | 1. Bad connection at gauge, connector plug or sender.<br>2. Sender defective.<br>3. Gauge defective. | |
| Ignition "ON" - no gauges or lights working. | 1. Dead battery.<br>2. Loose connection from battery to ignition switch.<br>3. Broken wire between battery and ignition switch.<br>4. Bad connection between circuit breaker or ignition switch to gauges. | |
| All electrical gauges working. No lights. | 1. Blown fuse in light circuit.<br>2. Bad light switch. | |

## ALTERNATING CURRENT CIRCUIT TESTS

### GENERAL

Alternating current (AC) charging system circuits are completely different from direct current (DC) charging systems. Therefore, none of the trouble shooting checks used for direct current systems can be used for alternating current systems. Before attempting to trouble shoot, the following precautions must be observed. Failure to do so may result in a burned out system:

When installing a battery, be absolutely sure the ground polarity of the battery and the ground polarity of the AC generator are the same.

When connecting a booster battery, be sure to connect the negative posts together and positive posts together.

When connecting a charger to the battery, be sure to connect the charger positive lead to the positive battery post and the negative lead to negative post.

Never operate AC generator on an open circuit. This condition is not only damaging to the generator but dangerous to anyone touching the generator "BAT" terminal.

Do not short across or ground any of the terminals of the AC generator or regulator.

Do not attempt to polarize the AC generator. Unlike the DC generator its polarity cannot be lost or changed.

Complaints involving the charging system are generally either on overcharged or undercharged battery. The following procedures list steps to locate the trouble that might exist in the system.

### TEST PROCEDURE

#### UNDERCHARGED BATTERY

This condition, as evidenced by slow cranking, can be caused by one or more of the following conditions.

LOOSE GENERATOR BELT - Adjust generator drive belt. Refer to "DRIVE BELT TENSION" under "SERVICE" in this section.

DEFECTIVE BATTERY - If a defective battery is suspected, follow procedures outlined under "BATTERY TEST PROCEDURES" in this section.

POOR CIRCUIT CONNECTIONS - Inspect all connections to be sure they are clean and tight, including the slip connectors at the regulator and generator. Check the wiring harness for grounds. Be sure that the regulator is properly grounded. Clean the battery posts and cable clamps to eliminate resistance. Make the following continuity checks with main electrical switch "on."

a. Slide a test prod into regulator No. 3 terminal, connect voltmeter from test prod to ground.

b. If reading is zero, circuit is open between No. 3 terminal and battery.

c. Connect voltmeter from regulator No. 2 terminal to ground.

d. If reading is zero, circuit is open between No. 2 terminal and ignition switch.

e. If reading is obtained at No. 2 terminal, connect voltmeter from regulator "F" terminal and ground.

f. If reading is zero, adjust regulator voltage setting or replace regulator.

g. If reading is obtained at regulator "F" terminal, connect voltmeter from generator "F" terminal to ground. Be sure that harness is properly connected to generator "F" terminal.

h. If reading is zero, circuit is open in lead between generator and regulator "F" terminals.

i. If reading is obtained, check for a defective generator.

DEFECTIVE GENERATOR - To determine if generator is operating properly, proceed as follows:

a. Disconnect battery ground strap.

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## ALTERNATING CURRENT CIRCUIT TESTS

b. Connect an ammeter in the circuit at the "BAT" terminal of the generator and a voltmeter from the "BAT" terminal to ground.

c. Connect a jumper lead to the harness connector as shown in (Fig. 12-29).

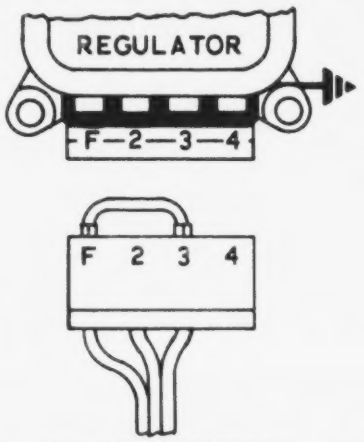


Figure 12-29

d. Reconnect battery ground strap.

e. Turn headlights on and blower motor to high speed.

f. Operate engine at 1500-2500 rpm as required to obtain maximum current output. CAUTION: If voltage exceeds 16 volts, connect a carbon pile across battery to keep voltage below 16 volts.

g. If ampere output is within 10 amperes of rated output as stamped on generator frame, generator is good. Otherwise repair generator.

h. An alternate method of checking generator output is to make connections as outlined above, operate at specified speed, and compare output with data in Generator Manufacturer's Specification Bulletins. Output may vary slightly depending on generator temperature.

i. Turn lights and blower off. Remove jumper lead from harness connector.

LOW VOLTAGE REGULATOR SETTING - If no reason for the discharged battery condition has been found by the preceding checks, refer to "ADJUSTING VOLTAGE SETTING."

### OVERCHARGED BATTERY

An overcharged battery as evidenced by excessive water usage can be caused by one or more of the following conditions.

DEFECTIVE BATTERY - If a defective battery is suspected, follow procedures outlined under "BATTERY TEST" in this section.

POOR CIRCUIT CONNECTIONS - Visually inspect all connections to be sure they are clean and tight, particularly the circuit between the battery, main electrical switch and the regulator No. 3 terminal and regulator ground.

HIGH VOLTAGE REGULATOR SETTING - If no circuit defects are found, yet the battery remains overcharged, refer to "ADJUSTING VOLTAGE SETTING."

### ADJUSTING VOLTAGE SETTING

It is important to remember that the voltage setting for one type of operating condition may not be satisfactory for another. The proper setting is attained when the battery remains fully charged with a minimum use of water.

The voltage at which the regulator operates varies with changes in regulator ambient temperatures. The ambient temperature is the temperature of the air measured 1/4 of an inch from the regulator cover. When checking and adjusting the voltage setting, always refer to the manufacturer's service bulletins for specifications.

To check and adjust the voltage setting, proceed as follows:

a. Insert a test prod into regulator No. 3 terminal, and connect a voltmeter from test prod to ground.

(Continued on next page)

## ALTERNATING CURRENT CIRCUIT TESTS

### TEST PROCEDURE - Continued

ADJUSTING VOLTAGE SETTING - Continued

b. Disconnect cable at battery negative post and insert 1/4 ohm 25 watt resistor in series.

NOTE: If battery is sufficiently charged to limit generator output to 10 amperes or less when adjusting voltage setting, 1/4 ohm resistor need not be used.

c. Short across resistor with jumper cable, start engine, remove jumper cable. Do not operate with battery disconnected.

d. With all accessories turned off and harness connected to regulator, operate engine at idle speed for 15 minutes to establish regulator operating temperature.

e. Cycle regulator by detaching then re-connecting harness connector at regulator.

f. Bring engine speed up to 2000-2200 rpm, note ambient temperature and voltage setting. Compare with manufacturer's specifications.

g. To adjust voltage setting detach regulator harness connector, remove cover, reconnect harness connector.

Turn adjusting screw (3, Fig. 12-30).

h. For undercharged battery raise setting to upper part of specification range.

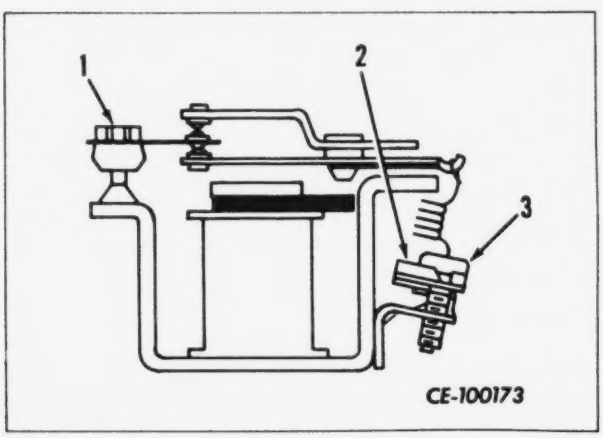


Figure 12-30

i. For overcharged battery lower setting to lower part of specification range.

NOTE: Be sure that springholder (2, Fig. 12-30) is against head of screw (3). When turning adjusting screw counterclockwise, turn until screw head is about 1/8" above holder, then pry holder up against screw head, then turn clockwise to make final setting.

j. After making setting, cycle by disconnecting then reconnecting harness connector at regulator.

k. Operate at 2000 - 2200 engine rpm and note setting. Re-adjust if necessary. Always cycle (Step j) before reading final voltage setting.

l. This procedure has adjusted setting while operating on upper or shorting contacts. Now proceed to adjust setting on lower or series contacts as follows.

m. Slowly decrease engine speed from the 2000-2200 rpm value and observe voltmeter. When operation changes from upper to lower contacts, voltmeter reading should suddenly decrease a few tenths of a volt. (See manufacturer's specifications.) Compare difference in voltage readings with specifications.

n. To decrease the difference in voltage between upper and lower contact operation, turn the nylon nut (1, Fig. 12-30) clockwise a slight amount. To increase difference turn nut counterclockwise. If this adjustment is made, voltage setting must be re-checked as covered in Steps e through m.

o. If voltage operation is erratic, and if regulator cannot be adjusted to a steady value, replace regulator. Do not attempt to clean contact points.

NOTE: Always remove harness connector at regulator when removing or replacing cover to avoid accidental grounds and consequent damage to regulator.

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## BATTERY TEST PROCEDURES

### GENERAL

Testing procedures are used to determine whether the battery is good and usable, requires recharging or should be replaced. Regular periodic testing provides a means of anticipating battery failure. Analysis of battery conditions can be accomplished by performing the following tests:

1. Visual Inspection
2. Light Load Test
3. Specific Gravity Cell Comparison Test
4. Full Charge Hydrometer Test

### VISUAL INSPECTION

The first step in testing the battery should be the visual checks, which very often save time and expense in determining battery condition.

Check the outside of the battery for a broken or cracked case and cell covers. If it shows signs of serious damage, the battery should be replaced.

Note the electrolyte level. Levels that are too low or too high cause serious battery problems.

Check for corroded areas on top of the battery, corroded or loose cable connections, corroded carrier and hold-down, evidence of overfilling and other similar visual conditions that can cause trouble.

### LIGHT LOAD TEST

The Light Load Test should be used on all batteries having individual cell covers. The equipment needed is an expanded scale voltmeter - one that has .01 volt per scale divisions. This test should be applied to batteries before they are charged. Otherwise, defective cells may pass the test and give a false diagnosis.

To check the electrical condition of battery cells using the Light Load Test:

a. First, check the electrolyte level in each cell; and, if needed, adjust it to the proper level by adding water.

b. Then, if the battery is in the vehicle, place a load on the battery by holding the starter switch "ON" for 3 seconds or until the engine starts. If the engine starts, turn off the ignition IMMEDIATELY. If the battery is out of the vehicle, place a 150 ampere load on it for 3 seconds.

c. Next, turn on the headlights or if the battery is out of vehicle, place a 10 ampere load on the battery. AFTER 1 minute, with lights still "ON," or with 10 ampere load, read the voltage of each battery cell with a voltmeter, noting the exact voltages. It is necessary to remember only the highest and lowest cell voltage.

Interpretation of Readings - The condition of the battery can be determined by noting the difference in voltage readings between the individual cells as follows:

Good Battery - Sufficiently Charged

If all cells read 1.95 volts or more and the difference between the highest and lowest cell is less than .05 volt (5 divisions), the battery is good and sufficiently charged.

Good Battery - Requires Charging

If cells read both above and below 1.95 volts and the difference between the highest and lowest cell is less than .05 volt (5 divisions), the battery is good, but requires charging. Refer to Battery Charging Guide (Fig. 12-31).

(Continued on next page)

## BATTERY TEST PROCEDURES

### LIGHT LOAD TEST - Continued

Replace Battery

If any cell reads 1.95 volts or more and there is a difference of .05 volt (5 divisions) or more between the highest and lowest cell, the battery is defective, damaged, or worn out and should be replaced.

Discharged Battery - Boost-Charge and Retest.

If all cells read less than 1.95 volts, the battery is too low to test accurately. Boost-charge and repeat the Light Load Test. Refer to Light Load Test Boost-Charge on Battery Charging Guide (Fig. 12-31). If the charger being used will not give the rate specified in the charging guide, charge for an equal number of ampere-minutes at the next lower rate available. For purposes of the Light Load Test do not boost battery more than the amount indicated.

If the battery is found to be good after boosting, it should be fully recharged for good performance. If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not come up after a second boost-charge should be replaced.

BATTERY CHARGING CHART

| Voltage of Battery | Amp-hour Capacity | Slow Charging (1) | Fast Charging | Emergency Boost Charging | Dry Battery Warm-Up Charge (2) | Light Load Test Boost Chg. (3) |
|---|---|---|---|---|---|---|
| 6 VOLT | 130 or less | 24 hours at 6 amps | 1-1/2 hours at 60 to 70 amps | 1/2 hour at 60 to 70 amps | 10 minutes at 30 amps | 1/2 hour at 60 amps |
| | Over 130 | 24 hours at 9 amps | 2 hours at 60 to 70 amps | 1 hour at 60 to 70 amps | 10 minutes at 30 amps | 1/2 hour at 60 amps |
| 12 VOLT | 100 or less | 24 hours at 4 amps | 1-1/2 hours at 40 to 50 amps | 1/2 hour at 40 to 50 amps | 10 minutes at 15 amps | 20 minutes at 50 amps |
| | Over 100 | 24 hours at 9 amps | 3 hours at 40 to 50 amps | 1-1/2 hours at 40 to 50 amps | 10 minutes at 30 amps | 1/2 hour at 60 amps |

(1) Slow charging is the best method of completely recharging batteries.
(2) For those dry charged batteries being activated with electrolyte at a temperature under 60°F. or those batteries which are expected to go into immediate operation in below freezing weather—
(3) For those batteries which require a boost charge for the "Light Load Test" procedure—

CE-100171

Figure 12-31

## BATTERY TEST PROCEDURES

### SPECIFIC GRAVITY CELL COMPARISON TEST

This test should be used only on batteries having one-piece cell covers. Measure the specific gravity of each cell, regardless of state of charge, and interpret results as follows:

If specific gravity readings show a difference between the highest and lowest cell of .050 (50 points) or more, the battery is defective and must be replaced.

If the maximum difference between cell readings is less than .050 (50 points) and the lowest cell reading is 1.200 or above, corrected for temperature, the battery is in good condition and may be returned to service.

If the maximum difference between cell readings is less than .050 (50 points), but the lowest cell reading is below 1.200, the battery is good but needs to be recharged by the Slow Charge method. (Refer to Fig. 12-31.)

### FULL CHARGE HYDROMETER TEST

This test should be used on batteries having individual cell covers and also on batteries having one-piece cell covers that have tested good by the Light Load Test or Specific Gravity Cell Comparison Test, but which subsequently fail in service.

a. Remove the battery from the vehicle, and correct the electrolyte level, if necessary.

b. Fully charge the battery at the Slow Charging rate recommended by the Charging Guide (Fig. 12-31). The battery is fully charged when cell gravity readings do not increase during three hourly checks. The cells should be gassing freely.

c. Note the specific gravity of the electrolyte in each cell and interpret as follows:

Hydrometer Reading Less Than 1.230 - Full charge hydrometer readings less than 1.230 indicate the battery is defective and must be replaced.

Hydrometer Readings Above 1.310 - Full charge hydrometer readings above 1.310 indicate that the cells have been improperly filled (activation) or improperly serviced. Poor service and short battery life will result.

### ANTICIPATE BATTERY FAILURE

Battery failure can be anticipated by periodically performing the Light Load Test, and recording the voltage difference between cells.

When a battery is new and all cells are in a good condition, the voltage difference between the cells is negligible or zero but increases gradually as the battery is used. Finally, a battery is replaced because one cell fails before the others. Voltage of the failing cell gradually diminishes, thus causing an increasing voltage difference between the cells. The battery should be replaced when the maximum voltage difference between the cells reaches .05 volt or more.

# ELECTRICAL SYSTEM

## DEFINITIONS

AMPERE - The electrical current produced by one volt acting through a resistance of one ohm.

AMPERE HOUR - A unit of measure for battery capacity, obtained by multiplying the current flow in amperes by the time in hours during which the current flows. For example, a battery delivering 3 amperes for 20 hours is rated at 60 ampere hours.

CIRCUIT - The complete path of an electrical current including, usually, the generating device. The complete path is referred to as a closed circuit. If the continuity is broken it becomes an open circuit.

FIELD - The lines of force set up by a permanent or electromagnet.

GROUND - The conducting body used as a common return for an electric circuit.

OHM - The resistance of a circuit in which a potential difference of one volt produces a current of one ampere.

POLARITY - The particular state, either positive or negative with regard to electrification.

RESISTANCE - The opposition offered by a substance or body, to the passage through it of an electric current.

VOLT - The electromotive force which steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

WATT - The work done by one ampere of current under one volt of pressure.

WATT-HOUR - The unit of electrical energy obtained by multiplying the ampere hour output by the average voltage during the discharge. Watt-hours = volts x amperes x hours.

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## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
| | | | |
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# SECTION XIII
# BRAKE SYSTEM

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SECTION XIII BRAKE SYSTEM


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## GENERAL INFORMATION

### DESCRIPTION

This section has been prepared for convenient reference to information on the H-100C Brake System. It presents a description of the Brake System, its maintenance and repair and repair of brake components.

The tractor brake system is a combination air over hydraulic type. An engine driven compressor supplies compressed air for the system. The compressed air is stored in the air reservoir. Air compressor output is regulated by a governor which is located between the compressor and the reservoir. Brake operation is controlled by two brake treadle valves. When a brake treadle is depressed, a flow of compressed air is directed from the reservoir to the power clusters. The air cylinders in the power clusters then act upon the hydraulic cylinder portions directing a flow of hydraulic fluid to the wheel cylinders in each brake assembly, applying the wheel brakes.

The late type system (Fig. 13-1) includes valving in the left hand treadle valve to apply the brakes automatically when the pressure drops to 50 psi. A warning buzzer sounds when the pressure drops to 60 psi.

Legend for Figure 13-1

1. Air compressor.
2. Governor.
3. To transmission disconnect.
4. Hydraulic brake line to right rear wheel cylinder.
5. Hydraulic brake line to left rear wheel cylinder.
6. Air pressure gauge.
7. Air pressure switch.
8. Right hand treadle valve.
9. Left hand treadle valve (includes section for automatic brake application).
10. Check valve.
11. To boom positioner.
12. Check valve.
13. Horn valve.
14. Horns.
15. Left hand power cluster.
16. Drain cocks.
17. Secondary air reservoir.
18. Primary air reservoir.
19. Right hand power cluster.
20. Hydraulic brake line to right front wheel cylinder.
21. Hydraulic brake line to left front wheel cylinder.
22. Wet reservoir.
23. Safety valve.
24. Drain valve.

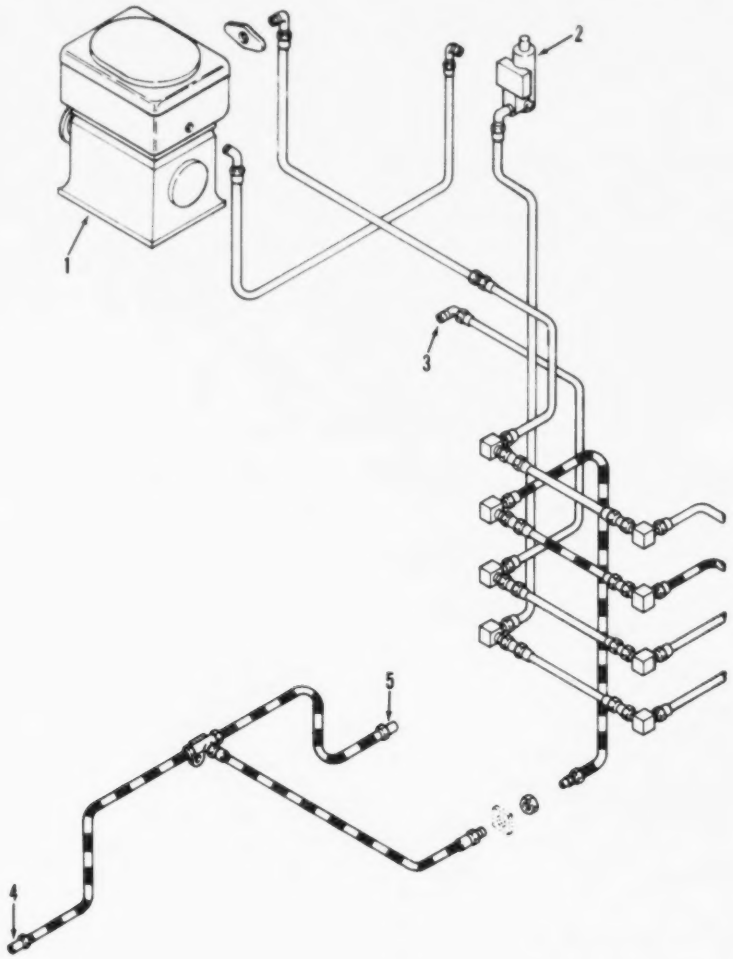


Figure 13-1
Brake System Schematic – Late Type Including
Low Pressure Automatic Brake Application.
(Sheet 1 of 2).



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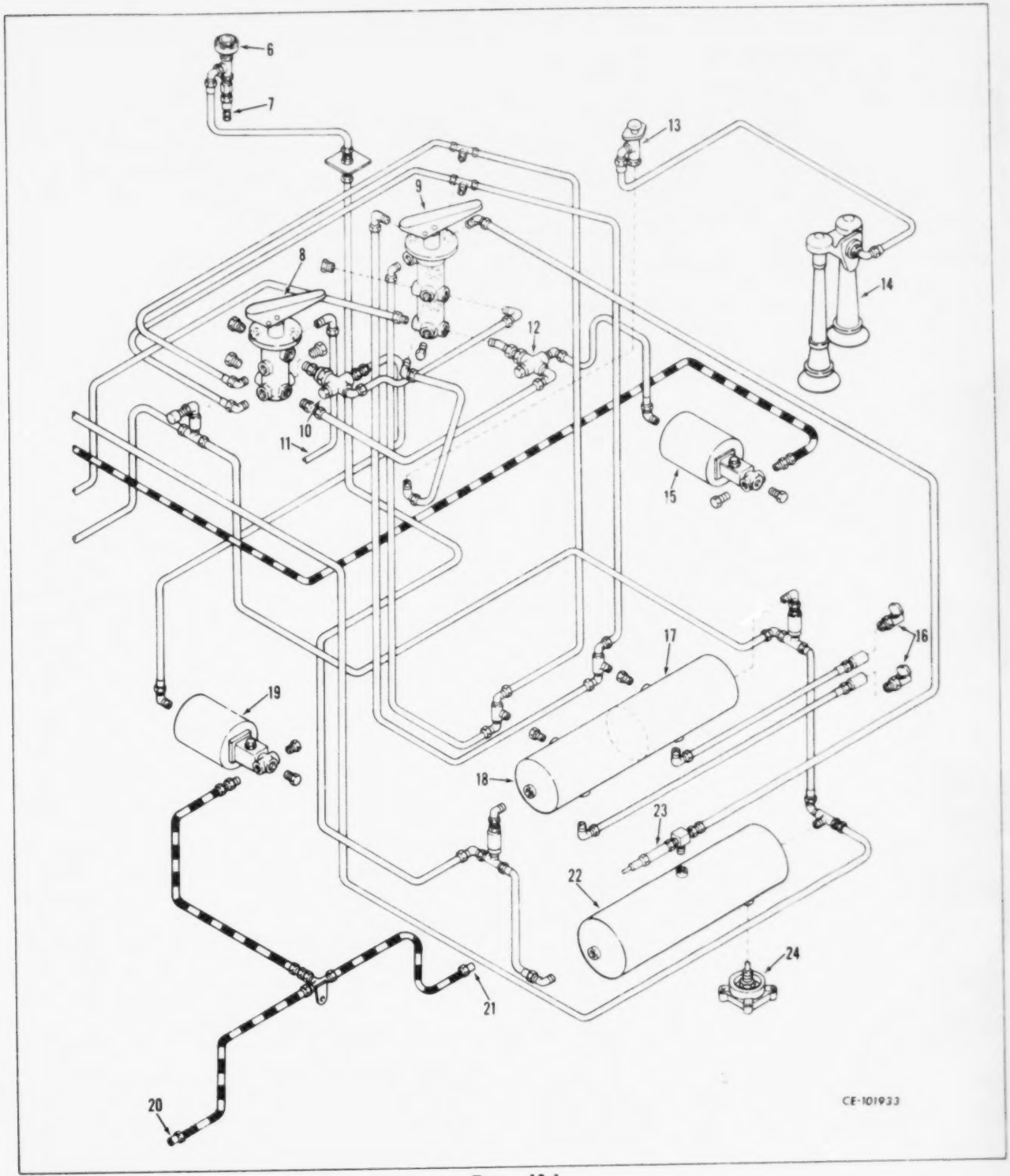


Figure 13-1
Brake System Schematic – Late Type Including
Low Pressure Automatic Brake Application
(Sheet 2 of 2).

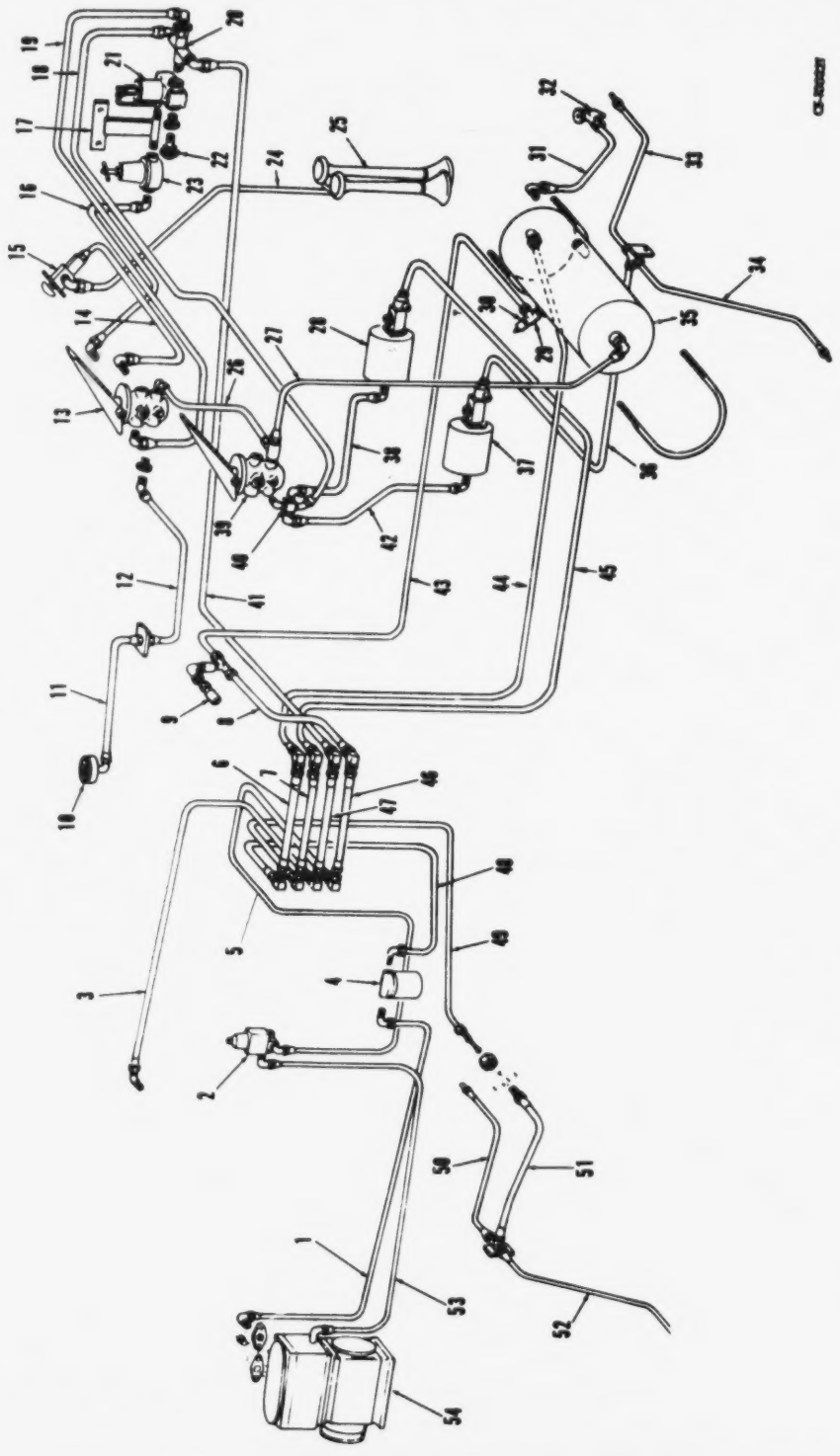

Figure 13-1A
Brake System Schematic – Early Type Without
Low Pressure Automatic Brake Application.



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## GENERAL INFORMATION

Legend for Figure 13-1A

1. Hose - compressor to alcohol injector.
2. Governor.
3. Tube - check valve to transmission disconnect.
4. Alcohol injector.
5. Tube - reservoir to governor.
6. Hose - alcohol injector to reservoir.
7. Hose - power cluster to rear brakes.
8. Tube - reservoir to governor.
9. Cap.
10. Air pressure gauge.
11. Tube - treadle valve to gauge.
12. Tube - treadle valve to gauge.
13. Treadle valve.
14. Tube - treadle valve to horn valve.
15. Horn valve.
16. Tube - regulator to treadle valve.
17. Support.
18. Tube - left hand check valve to right hand check valve.
19. Tube - treadle valve.
20. Left hand check valve.
21. Air solenoid valve.
22. Breather.
23. Pressure regulator.
24. Tube - horn valve to air horn.
25. Air horn.
26. Hose - right hand treadle valve to left hand treadle valve.
27. Tube - reservoir to treadle valve.
28. Left hand power cluster.
29. Tee.
30. Safety valve.
31. Tube - reservoir drain.
32. Drain cock.
33. Tube - tee to front brakes.
34. Tube - tee to front brakes.
35. Reservoir.
36. Tube - power cluster to tee.
37. Right hand power cluster.
38. Tube - check valve to power cluster.
39. Right hand treadle valve.
40. Right hand check valve.
41. Tube - check valve to transmission disconnect.
42. Tube - power cluster to treadle valve.
43. Tube - reservoir to governor.
44. Tube - alcohol injector to reservoir.
45. Tube - power cluster to rear brakes.
46. Hose - reservoir to governor.
47. Hose - check valve to transmission disconnect.
48. Tube - alcohol injector to reservoir.
49. Tube - power cluster to rear brakes.
50. Tube - tee to rear brakes.
51. Tube - tee to power cluster.
52. Tube - tee to rear brakes.
53. Hose - compressor to governor.
54. Air compressor.

## PREVENTIVE MAINTENANCE

In order to insure proper operation, the brake system components should be properly maintained.

Periodic maintenance operations are listed in the table on page 4. These operations should be performed at the time intervals listed.

### DRAIN RESERVOIR

The compressed air system should be kept as moisture-free as possible. If the ambient temperature is cold, moisture in the air system will freeze causing the system to become inoperative. The reservoir is equipped with a drain cock (Fig. 13-2) to drain off any water or oil.

(Continued on next page)

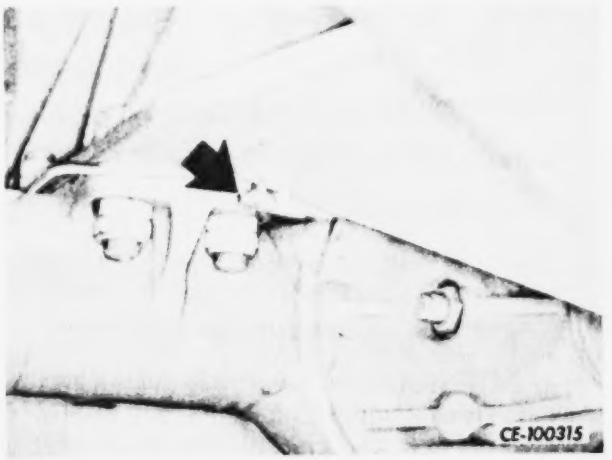


Figure 13-2

# BRAKE SYSTEM

## GENERAL INFORMATION

### PREVENTIVE MAINTENANCE - Continued

| MAINTENANCE OPERATIONS | HOUR INTERVAL | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 | 100 | 200 | 500 | 1000 | 1500 | 3000 |
| Drain moisture from reservoirs | X | X | X | X | X | X | X |
| Check fluid level in power clusters | X | X | X | X | X | X | X |
| Check compressed air system | | | X | X | X | X | X |
| Lubricate brake treadle valves | | | X | X | X | X | X |
| Check and adjust brake lining to drum clearance | | | X | X | X | X | X |
| Clean or replace governor filters | | | | X | X | X | X |
| Inspect brake treadle valves | | | | X | X | X | X |
| Inspect air compressor | | | | | X | X | X |
| Check and adjust compressor unloader valve clearance | | | | | X | X | X |
| Disassemble and clean safety valve | | | | | | X | X |
| Disassemble and clean double check valve | | | | | | X | X |
| Disassemble and clean moisture ejector valve | | | | | | X | X |
| Disassemble and clean air compressor | | | | | | | X |
| Disassemble and clean governor | | | | | | | X |
| Disassemble and clean treadle valves | | | | | | | X |

#### CHECK FLUID LEVEL IN POWER CLUSTERS

Hydraulic brake fluid level in power clusters should be kept within 1/2 inch to 3/8 inch of filler hole to prevent possibility of air entering hydraulic brake system. Clean around filler hole before removing plug. If fluid must be added, use type listed in "LUBRICANT."

#### CHECK COMPRESSED AIR SYSTEM

Both compression and application parts of the air system should be checked periodically. Exhaust any air that may be present in system by making several brake applications or by opening all air tank drain valves. Close drain valves after exhausting all compressed air from sys-

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## GENERAL INFORMATION

tem. Air system gauge on instrument panel should indicate that no pressure is present in system. Start engine to build system pressure. With all air system devices in a non-apply condition and engine running at fast idle, the pressurizing part of the system should develop 50 to 90 pounds within 5 minutes. After system governor cuts out at maximum system pressure, stop engine. Leakage rate in pressurizing part of air system should not exceed 2 pounds per minute. With brakes fully applied, leakage rate in application part of air system should not exceed 3 pounds per minute.

If pressure drops are excessive in either part of the air system, check the system for leaks. Cover all tubing connections, valve port openings and gaskets with soap suds. Leaks will be indicated by the formation of bubbles in the soap suds.

### BRAKE TREADLE VALVES

Lift boot under treadle away from mounting plate and lubricate valve plunger with a few drops of SAE 20 DS Oil (MIL-L-2104). Wipe off excess oil and replace boot on mounting plate. Avoid using too much oil. It could contact and deteriorate rubber spring in top of valve.

Inspect inlet and exhaust valve, exhaust diaphragm, "O" rings, and rubber graduating spring. If any parts show signs of wear or damage, they should be replaced.

Disassemble and clean the tractor brake treadle valves periodically to insure proper operation. Refer to "BRAKE TREADLES" for service procedures.

### GOVERNOR

The two small screen filters in the compressor and reservoir ports of the governor should be cleaned or replaced periodically. To clean, disconnect air lines to governor and rinse filters with a cleaning solvent that is known to have no detrimental effect on metal or rubber materials. If filters are removed, they should be replaced.

The governor should be disassembled, cleaned, and reset to assure proper operation. Refer to "GOVERNOR" for service procedures.

### AIR COMPRESSOR

Remove compressor discharge line and check for excessive carbon build-up. If excessive carbon is found, clean or replace compressor cylinder head. The discharge line should also be inspected and replaced if necessary.

The air compressor on the I. H. engine should be disassembled, cleaned and assembled at recommended intervals. Refer to "DISASSEMBLY, INSPECTION AND ASSEMBLY".

Service air compressor on tractors equipped with Cummins engines per manufacturer's recommendations. Refer to Manufacturer's Service Publications.

### SAFETY VALVE

The safety valve on the reservoir should be disassembled, cleaned and reset to assure proper operation. Refer to "SAFETY VALVE" for service procedures.

### DOUBLE CHECK VALVE

The double check valve should be disassembled and cleaned periodically to assure proper operation. Refer to "DOUBLE CHECK VALVE" for service procedures.

### ADJUST BRAKES

Jack up wheel to be adjusted. Remove adjustment covers in the brake backing plate. Using a brake adjusting tool, rotate the star wheels until lining drags on drum. Rotate wheel being adjusted.

Rotate star wheels in opposite direction until drag is relieved.

## REQUIRED TOOLS

Standard Mechanics Hand Tool Set.
Torque Wrench - 0-500 ft. lbs. rating.

## GENERAL

Disassembly, inspection and assembly instructions for the tractor brake system are given in this section.

Before servicing any portion of the brake system, park the tractor on a level surface, preferably in an enclosure and set the parking brake. The tractor wheels may also be blocked to prevent the tractor from rolling. Lower the bucket to ground level and shut down engine. Release the air from the system by opening the reservoir drains.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### GOVERNOR

#### REMOVAL

Disconnect air lines from governor. Remove cap screws, lock washers and nuts that secure governor. Remove governor.

#### DISASSEMBLY

Clean exterior of governor with a good cleaning solvent.

Remove pipe plugs (1, Fig. 13-3) from governor body (2).

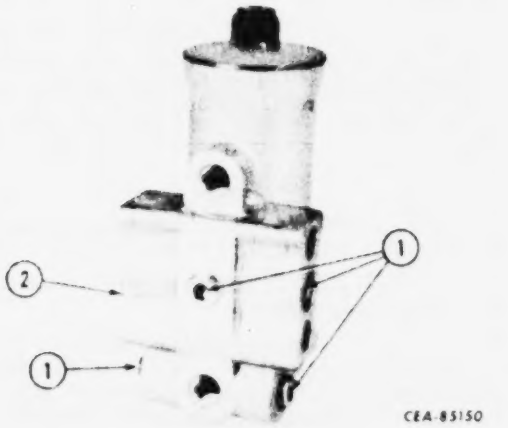


Figure 13-3

Unscrew cover (3, Fig. 13-4). Using a snap ring pliers, remove retaining ring (2) from governor body (4). Slide adjusting screws and spring assembly (1) from body.

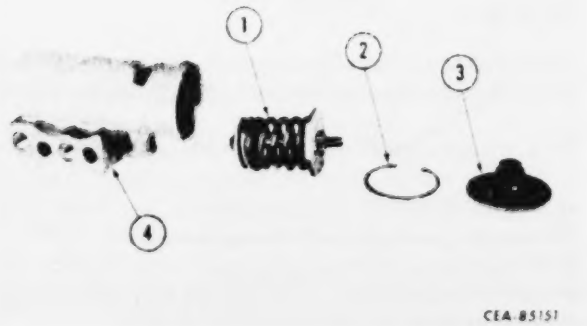


Figure 13-4

Remove lock nut (7, Fig. 13-5) from adjusting screw (1). Unscrew adjusting screw (1) from upper spring seat (6). Remove spring (5), lower spring seats (2 and 4), and guide (3).

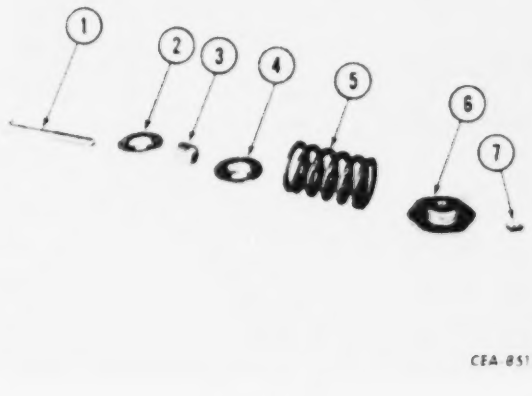


Figure 13-5

Slide piston assembly (1, Fig. 13-6) out of governor body (2).

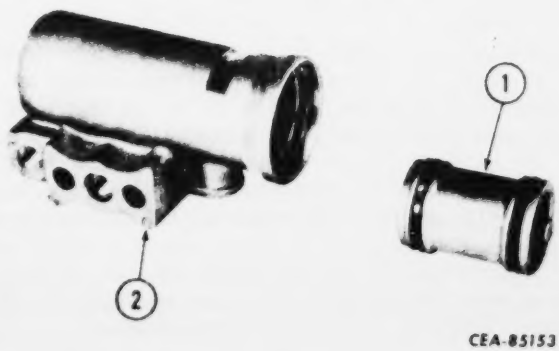


Figure 13-6

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove "O" rings (1, Fig. 13-7) from piston (4). Remove spring (2) and valve (3). Slide exhaust stem (8), and spring (7) out of piston. Remove washer (6) and "O" ring (5).

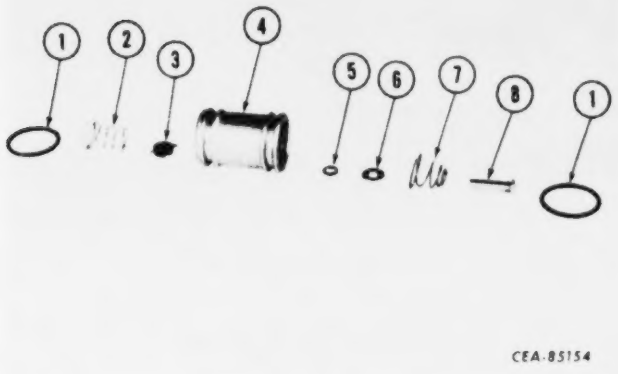


Figure 13-7

Remove filter screws (1, Fig. 13-8) from the ports (2) in the governor body.

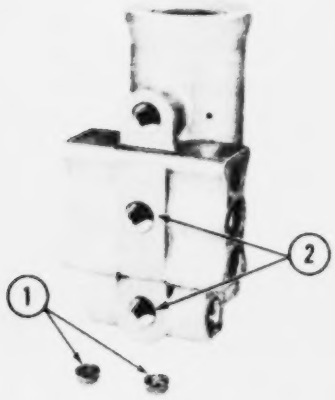


Figure 13-8

### CLEANING AND INSPECTION

Clean and inspect all parts as follows:

a. Clean all metal parts in good cleaning solvent. Use compressed air to dry parts.

b. Inspect all parts for wear or damage. Check governor body for cracks or other damage. Be certain that all air passages in body, piston, and exhaust stem are clean. Check springs for cracks or distortion. Replace all parts found to be worn or damaged.

c. Replace all "O" rings in governor.

### ASSEMBLY

Prior to reassembly, lubricate lower body bore, top of piston "O" rings, spring guide and adjusting screw with a good barium base grease (Bendix-Westinghouse Part No. 240176).

Install exhaust stem "O" ring (5, Fig. 13-7) in piston (4) and cover with washer (6). Drop valve (3) into piston and install spring (2) with its small end towards valve (3). Press spring (2) in until its large coiled end snaps into groove in piston. Place exhaust stem spring (7) on stem (8) and install in piston. Place "O" rings (1) on piston.

Install piston assembly (1, Fig. 13-6) in governor body (2).

Install lower spring seat (2, Fig. 13-5), guide (3), and spring seat (4) on adjusting screw (1). Place spring (5), upper spring seat (6), and lock nut (7) on adjusting screw.

Screw upper spring seat down until dimension between adjusting screw head and upper spring seat is approximately 1-7/8 in. Fig. 13-9.

(Continued on next page)

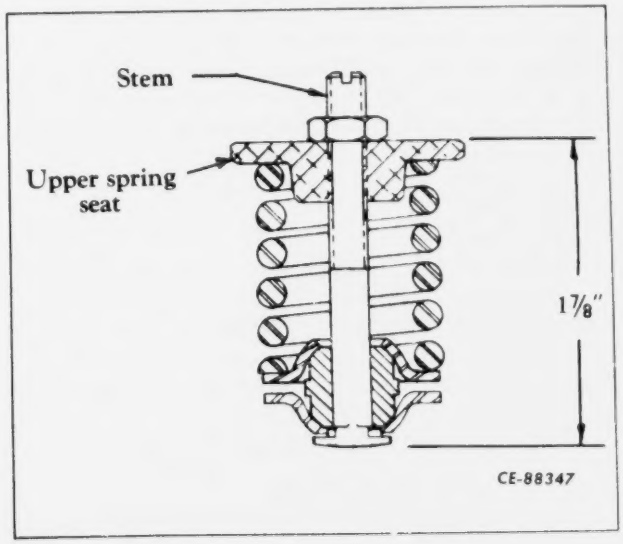


Figure 13-9

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### GOVERNOR - Continued

#### ASSEMBLY - Continued

Insert adjusting screw and spring assembly (1, Fig. 13-4) into governor body (4). Install retaining ring (2) with a snap ring pliers. Screw cover (3) in place.

Install new filter screens (1, Fig. 13-8) in governor body unloader and reservoir ports (2). Screens can be inserted with blunt end of a pencil.

Install pipe plugs (1, Fig. 13-3) in ports in governor body. Coat pipe plugs with a small amount of Mar-Seal or a similar sealant before installing.

#### INSTALLATION

Install governor and secure with cap screws, lock washers and nuts. Attach air lines.

Make final adjustments to governor as described below.

#### ADJUSTMENT

Start tractor engine and build up air system pressure. Note pressure at which governor cuts out. This pressure should be as listed in "SPECIFICATIONS." If cutout pressure is incorrect remove governor cover, loosen lock nut, and using a screwdriver, turn the adjusting screw clockwise to lower setting, and counterclockwise to raise it. When proper adjustment is obtained, tighten lock nut and install cover.

### RESERVOIR

#### REMOVAL

Disconnect lines and safety valve (1, Fig. 13-10) from reservoir (2). Remove "U" bolts (3) and lock nuts that secure reservoir to frame.

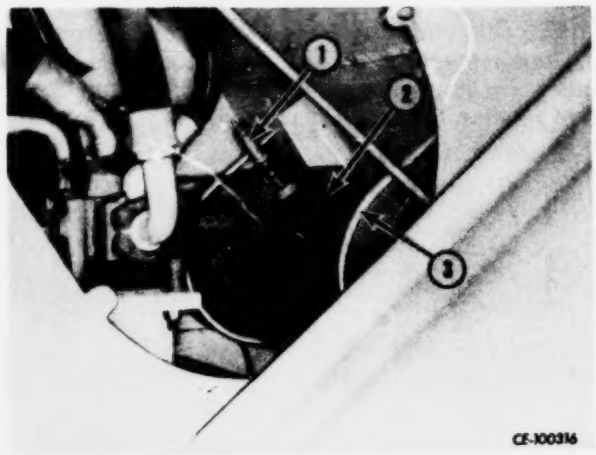


Figure 13-10

#### CLEANING AND INSPECTION

Clean and inspect air reservoir as follows:

Clean exterior and interior of reservoir with hot water and steam.

Inspect exterior of reservoir for damage or corrosion. A badly damaged reservoir should be replaced. Keep exterior of the reservoir painted to retard corrosion.

NOTE: Use water pressure to test air reservoirs for leaks, if tests are to be made at pressures higher than normal.

#### INSTALLATION

Attach reservoir (2, Fig. 13-10) to frame using "U" bolts (3) and lock nuts. Connect safety valve (1) and lines to reservoir.

### SAFETY VALVE

#### REMOVAL

Unscrew safety valve (1, Fig. 13-11) from tee (2) on reservoir (3).



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

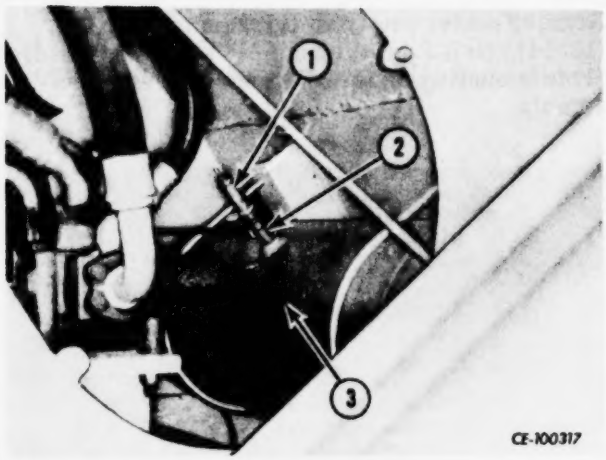


Figure 13-11

### DISASSEMBLY

Unscrew spring cage (5, Fig. 13-12) from body (1). Lift ball (2) from body. Remove release pin (3) and spring (4) from spring cage.

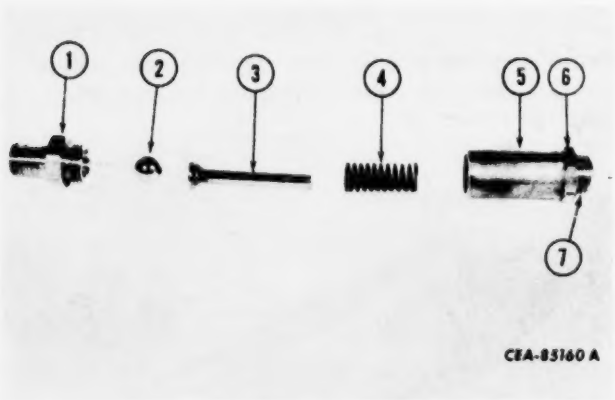


Figure 13-12

### CLEANING AND INSPECTION

Clean and inspect safety valve as follows:

Clean all parts in a good cleaning solvent. Use compressed air to dry parts.

Inspect ball for signs of pitting or scratches. If ball is damaged it should be replaced. Clean ball seat thoroughly.

Inspect body and spring cage for cracks, and replace if any are found.

Check to be sure that exhaust port in spring cage is not plugged.

### ASSEMBLY

Place spring (4, Fig. 13-12) on release pin (3) and insert assembly in spring cage (5). Place ball (2) in body (1). Position spring cage, release pin and spring over ball and screw cage into body.

### INSTALLATION

Screw safety valve (1, Fig. 13-11) into tee (2) on reservoir (3).

### ADJUSTMENT

Using the necessary equipment, test and adjust the safety valve as follows:

a. Pull on exposed end of safety valve release pin. This removes spring load from ball and permits valve to exhaust.

b. If valve does not "blow off" when this is done, ball is stuck on its seat. Valve should be removed and cleaned.

c. Coat exhaust port in spring cage with soap suds to test leakage. Leakage should not exceed a three inch soap bubble in three seconds.

d. The safety valve should be set to "blow off" at approximately 150 psi. Setting may be adjusted by loosening lock nut and turning adjusting screw.

e. Turn adjusting screw clockwise to raise pressure setting, and counterclockwise to lower setting.

f. Tighten lock nut after each adjustment.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### TREADLE VALVES

#### REMOVAL

Completely exhaust all air from reservoirs. Disconnect all air line connections to treadle valves (1, 2, Fig. 13-13). Tag all lines so they will connect properly at installation.

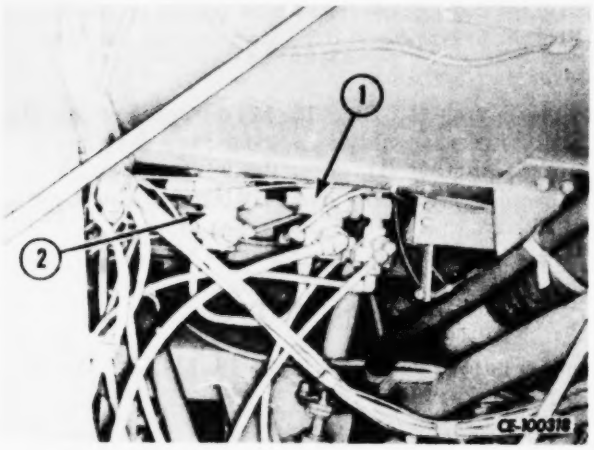


Figure 13-13

Disconnect any treadle fittings that would prevent treadle removal through cut-out in floorboard. Remove hardware securing treadle to floorboard. Remove treadle valve.

NOTE: On late type brake systems the treadle valve furthest to left of operator has one section more than right hand valve. This extra "Tandemergency" section provides for automatic application of vehicle brakes in case of air failure. The following disassembly instructions up to and including removal of plunger boot (2, Fig. 13-16) are applicable for both valves.

#### DISASSEMBLY

Clean outside of treadle valve with a good grade cleaning solvent.

Place treadle valve on a clean work bench.

Remove cotter pin from fulcrum pin (2, Fig. (13-14). Drive out fulcrum pin securing treadle (1) to mounting plate (3). Remove treadle assembly.

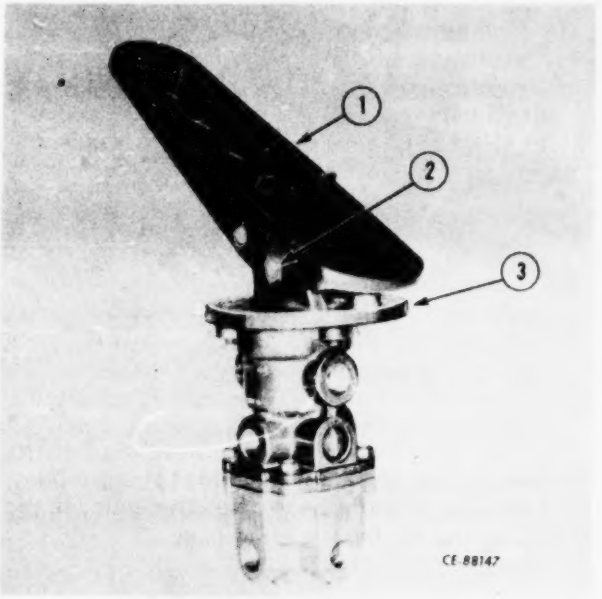


Figure 13-14

Remove cotter pin (2, Fig. 13-15) from roller pin (3). Remove roller pin from treadle (1). Remove roller (3).

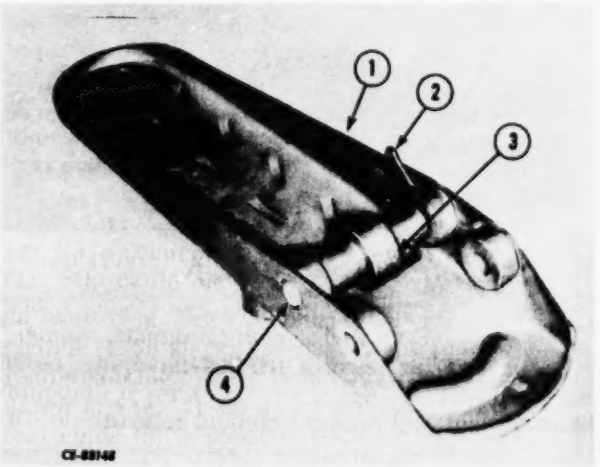


Figure 13-15



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove rubber boot (1, Fig. 13-16) from plunger (2) and mounting plate (4). Remove treadle stop nut and set screw (3) from mounting plate.

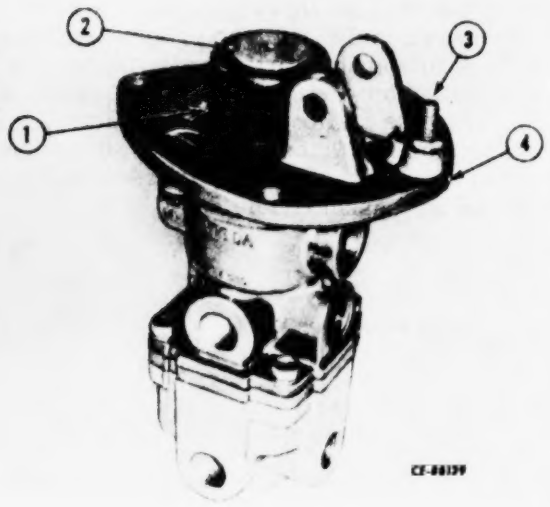


Figure 13-16

RIGHT TREADLE VALVE - Remove plunger (2, Fig. 13-17) from mounting plate (1).

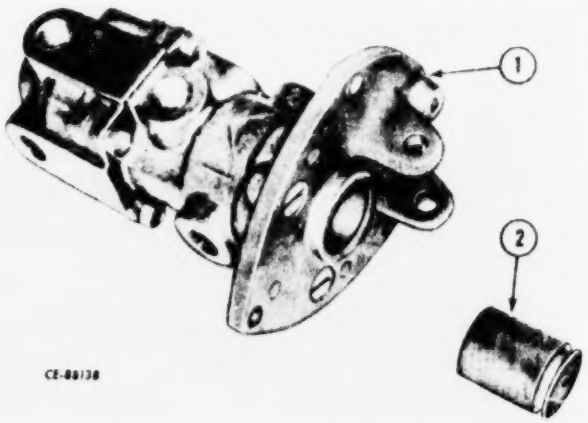


Figure 13-17

BOTH VALVES - Punch mark mounting plate (2, Fig. 13-18) and body (1) for reference during assembly.

Remove screws (3) that secure mounting plate (2) to body (1). Remove mounting plate.

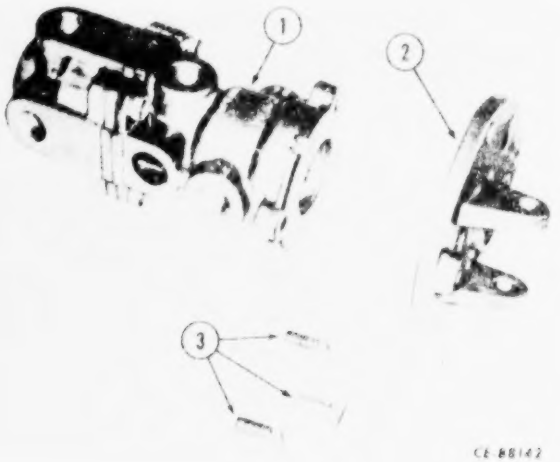


Figure 13-18

LEFT TREADLE VALVE - The following instructions are for the extra "Tandemergency" section only.

Punch mark section and body for assembly reference. Carefully remove hardware (4, Fig. 13-19) securing section (3) to body (1). Remove gasket (2).

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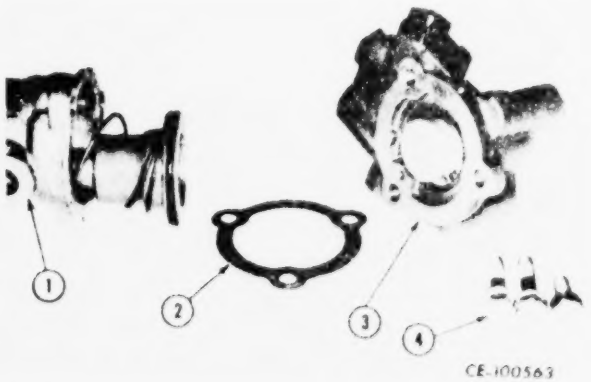



Figure 13-19

## DISASSEMBLY, INSPECTION AND ASSEMBLY

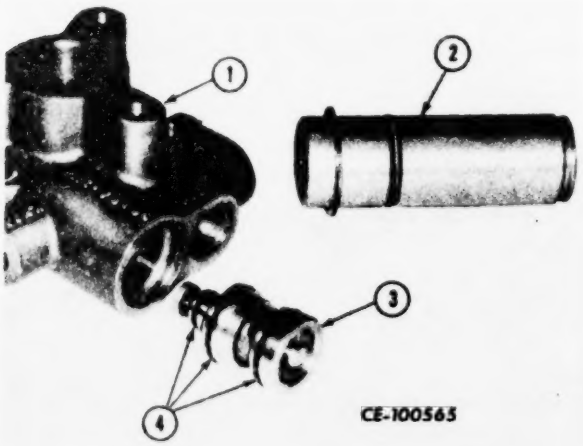
### TREADLE VALVES - Continued

DISASSEMBLY - Continued

Remove plugs (5, Fig. 13-20) from section (1). Do not damage copper washers (3). Remove screens (4) and springs (2) from plugs. Remove snap ring (6) with snap ring pliers. Spring (8) and seat (7) will pop out.

Figure 13-20

Push plunger (2, Fig. 13-21) down through section (1) to remove. Remove and discard seal ring from plunger. Tap section sharply on wooden block to pop valve (3) out of section. Discard valve "O" rings (4).




BOTH VALVES - Depress primary piston assembly (3, Fig. 13-22) and remove retaining ring (4). Remove piston assembly and spring (2) from upper body (1).

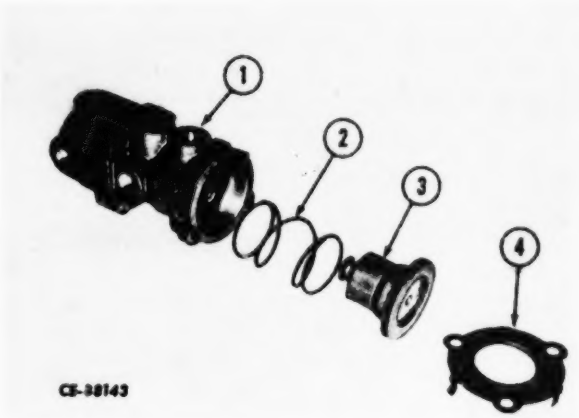



Figure 13-22

NOTE: Retaining ring (4) not used in "Tandemergency" valve.

Using snap ring pliers, remove retaining ring (5, Fig. 13-23). Remove spring retainer (4) and spring (3) from piston (1). Discard "O" ring (2) from groove in piston.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Punch mark upper and lower body for assembly reference. After removing cap screws (6, Fig. 13-24) separate upper valve body (5) from cover (2) and lower valve body (1). Remove push rod (3) and push rod guide (4).

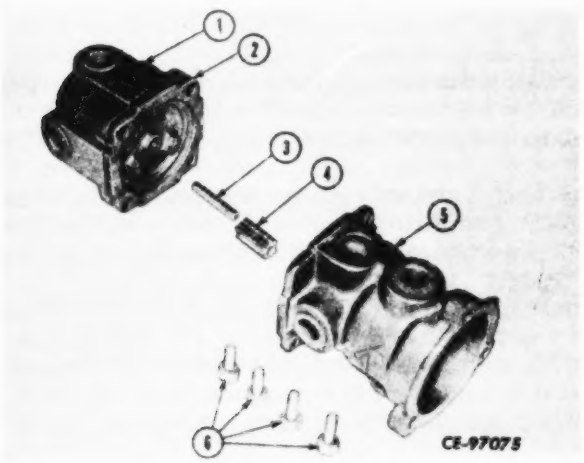


Figure 13-24

Having removed and separated push rod (7, Fig. 13-25) and push rod guide (6), remove primary inlet valve guide (5) from upper valve body (1). Discard seal (4) from outer groove of valve guide (5) and packing from inner groove. Separate primary inlet spring (3) and valve (2).

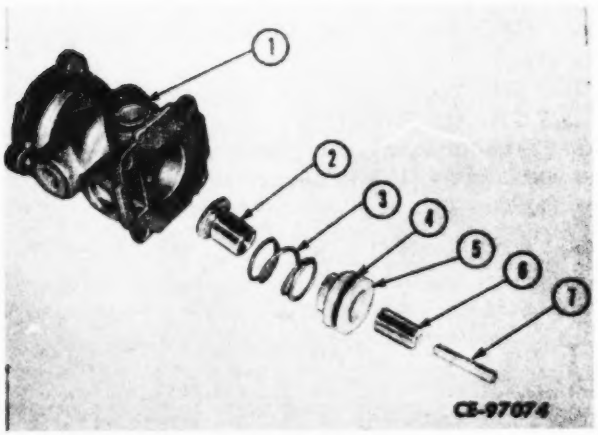


Figure 13-25

Punch mark valve body (1, Fig. 13-25A) and cover (7). Remove cover (7) from lower valve body.(1). Discard seal (6) from groove in cover.

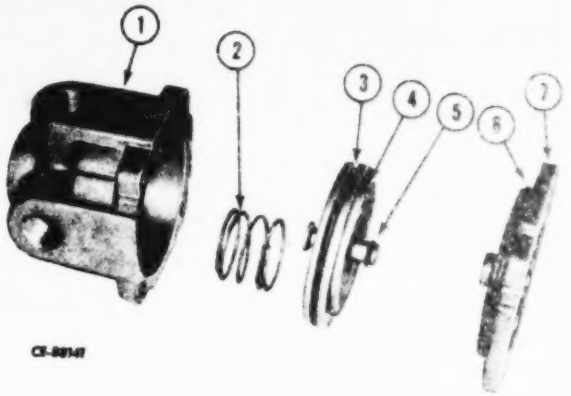


Figure 13-25A

Remove secondary piston (4) from body. Discard small "O" ring (5) and large "O" ring (3) from grooves in piston. Remove spring (2) from body.

Using snap ring pliers, remove retaining ring (1, Fig. 13-25B). Remove exhaust shield (2) and inlet and exhaust valve assembly (3) from lower body (4).

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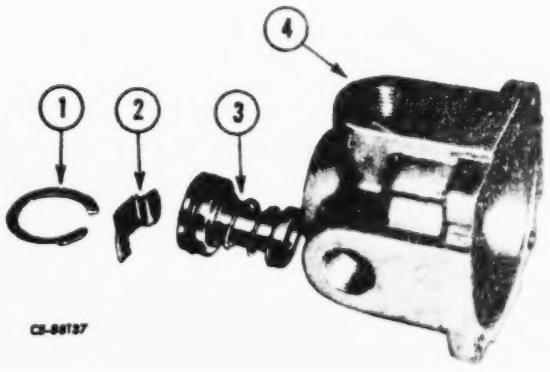


Figure 13-25B

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### TREADLE VALVES - Continued

DISASSEMBLY - Continued

Disassemble valve assembly (3, Fig. 13-25B) by removing inlet valve (6, Fig. 13-25C), spring (5), valve guide (4) and seal (3) from shield retainer (1). Remove vee packing (2) from groove in retainer. Discard seal (3).

Figure 13-25C

INSPECTION

Clean and inspect the treadle valves as follows:

a. Clean all parts in good cleaning solvent using compressed air to dry parts.

b. Wipe all rubber parts clean.

c. Inspect valve seats for nicks and burrs.

d. Check springs for cracks, distortion or corrosion.

e. Check exhaust valve diaphragm for flexibility, wear, and deterioration.

f. Replace all "O" rings, seals, gaskets and parts found to be worn or damaged.

ASSEMBLY

Lightly lubricate piston, valve bores, and "O" rings prior to assembly.

Install vee packing (2, Fig. 13-25C) in groove of shield retainer (1). Install a new seal (3) and guide (4) on retainer. Insert inlet valve (6) into spring (5), guide and retainer.

Insert inlet and exhaust valve assembly (3, Fig. 13-25B) and exhaust shield (2) into lower body (4) and secure with retaining ring (1).

Install a new large "O" ring (3, Fig. 13-25A) and a new small "O" ring (5) on secondary piston (4). Install new seal (6) on cover (7). Insert spring (2), piston and cover into lower body (1). Match previously made punch marks.

Install new seal (4, Fig. 13-25) in outer groove and packing in inner groove of valve guide (5). Insert primary inlet valve (2) into spring (3) and valve guide(5) and insert into upper valve body (1). Slip push rod guide (6) and push rod (7) into valve in upper valve body.

Align previously made punch marks and secure lower body (1, Fig. 13-24), cover (2) and upper body (5) with cap screws and lock washers (6).

Install a new "O" ring (2, Fig. 13-23) in groove on primary piston (1). Insert spring (3) and retainer (4) into piston and secure with retaining ring (5).

RIGHT TREADLE VALVE - Insert spring (2, Fig. 13-22) and primary piston assembly (3) into upper body (1) and secure with retaining ring (4).



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

LEFT TREADLE VALVE - The following is for the "Tandemergency" section only.

Install new "O" rings (4, Fig. 13-21) on valve (3) and carefully insert into bore of section (1). Install new seal ring on plunger (2) and slide plunger into section, from bottom up. Replace plunger snap ring if required.

Insert screens (4, Fig. 13-20) into plugs (5). Seat them with a blunt stick or pencil eraser. Slip copper washers (3) over plugs. Seat springs (2) in plugs and install in proper bores in section (1). Tighten plugs securely. Slide spring (8) onto spring seat of valve. Place spring seat (7) over spring and compress spring with seat. Install snap ring (6) while holding spring compressed with seat. Install spring (2, Fig. 13-22) and primary piston assembly (3) into valve body (1, Fig. 13-19). Position new gasket (2) on body. Align punch marks on body and section (3), compress spring and install hardware (4). Tighten cap screws evenly and securely.

BOTH VALVES - Place mounting plate (2, Fig. 13-18) on valve body (1), aligning punch marks made at disassembly, and secure with screws (3).

Insert plunger (2, Fig. 13-17) into mounting plate (1) of right-hand treadle valve.

Install treadle stop nut and set screw (3, Fig. 13-16) in mounting plate (4). Install rubber boot over (1) plunger (2).

Place roller (3, Fig. 13-15) in treadle (1). Insert roller pin (4) through treadle and roller and secure with cotter pin (2).

Place treadle assembly (1, Fig. 13-14) on mounting plate (3) and insert fulcrum pin (2). Align holes in treadle and fulcrum pin and insert cotter pin.

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### TREADLE VALVES - Continued

#### INSTALLATION

Install the treadle through the hole in the floorboard and secure with the cap screws and nuts.

Install the pipe plugs and pipe fittings in the treadle valve ports from which they were removed.

Connect the air lines to the proper ports on the valve.

### DOUBLE CHECK VALVES

#### REMOVAL

Disconnect and tag all air lines at double check valves.

Unscrew double check valves from right hand treadle valve and air solenoid valve.

#### DISASSEMBLY

Remove cap screws and lock washers (1, Fig. 13-26). Separate cap (2) from body (6). Remove gasket (3) (some units use "O" ring in place of gasket), insert (4) and shuttle (5).

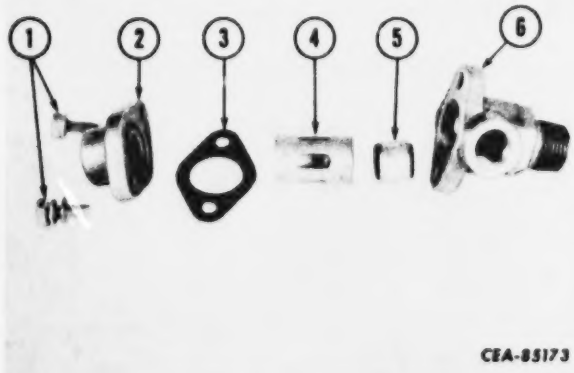


Figure 13-26

#### CLEANING AND INSPECTION

Clean and inspect the double check valve as follows:

Clean all metal parts in good cleaning solvent. Use compressed air to dry parts.

Inspect metal shuttle for damage.

Inspect body and end cap for signs of wear or damage.

Inspect insert for wear.

Replace gasket and any parts found to be damaged.

#### ASSEMBLY

Lightly oil shuttle (5, Fig. 13-26) prior to assembly. Place insert (4) in groove of cap (2) and place shuttle (5) in insert. Place gasket (3) (or "O" ring) on cap and place cap on body (6). Install and tighten cap screws and lock washers (1).

#### INSTALLATION

Screw double check valves into right hand treadle valve and air solenoid.

Connect all air lines to double check valves.

### POWER CLUSTERS

#### REMOVAL

Disconnect air line (1, Fig. 13-27) at power cluster and hydraulic line (2). Remove nuts and lock washers that secure power cluster to frame. Remove power cluster.

If right cluster is being removed, stop light switch wires must be removed.


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## DISASSEMBLY, INSPECTION AND ASSEMBLY

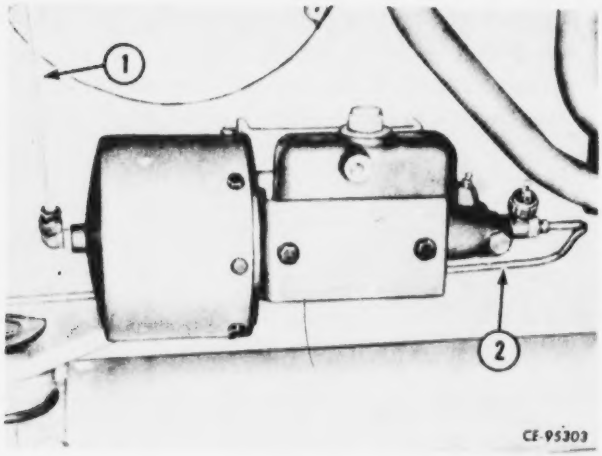


Figure 13-27

### DISASSEMBLY

Remove hydraulic cylinder filler cap and drain hydraulic fluid.

Wash exterior of power cluster with a good grade cleaning solvent.

Remove cap screws and lock washers (2, Fig. 13-28) that attach hydraulic cylinder (1) to bracket (3).

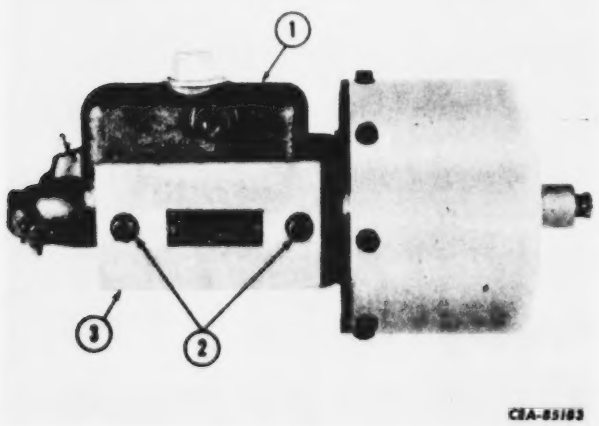


Figure 13-28

Remove mounting studs (3, Fig. 13-29) that attach hydraulic cylinder (2) to bracket (1). Remove hydraulic cylinder.

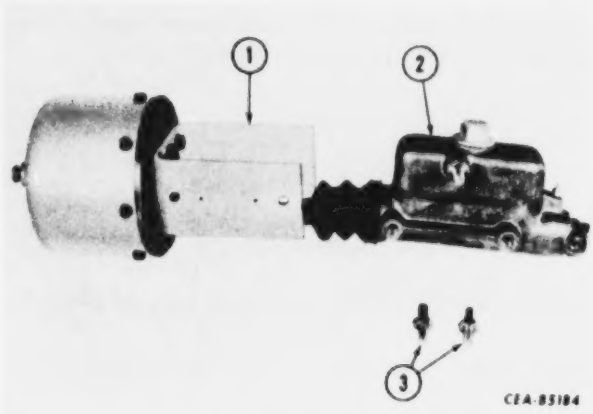


Figure 13-29

Remove cap screws and lock washers (2, Fig. 13-30) that secure bracket (1) to air cylinder (3). Remove bracket.

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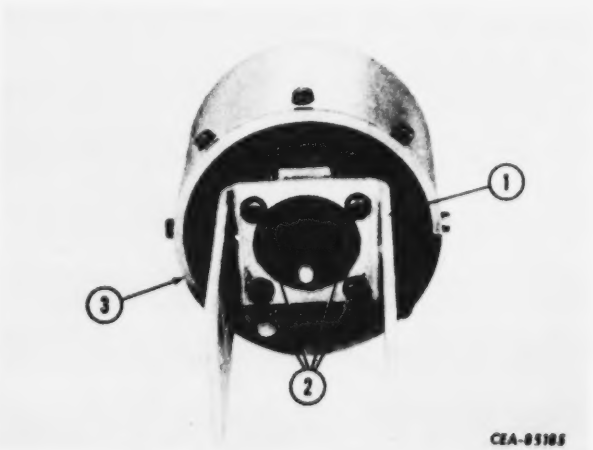


Figure 13-30

NOTE: Late model units are equipped with an indicator rod which is installed in place of the lower right hand bolt shown in Fig. 13-30. Also, an external breather replaces the filter screen just below the lower left hand bolt.

## POWER CLUSTERS - Continued

DISASSEMBLY - Continued

Remove cap screws and lock washers (4, Fig. 13-31) that fasten shell (1) to head (3). Remove head and piston return spring (2). On units so equipped, remove indicator rod and return spring, and unscrew breather from face of head (3).

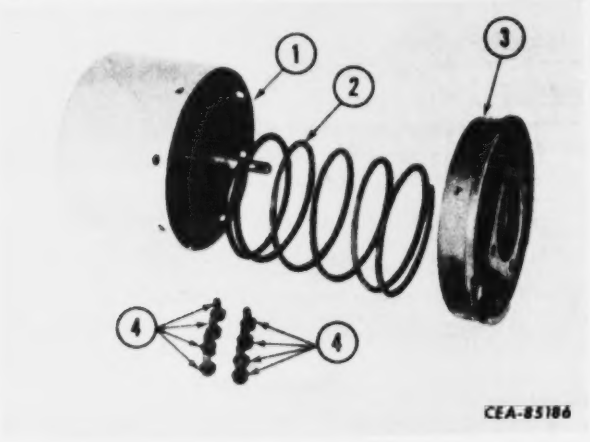


Figure 13-31

Slide piston and rod assembly (2, Fig. 13-32) out of shell (1).

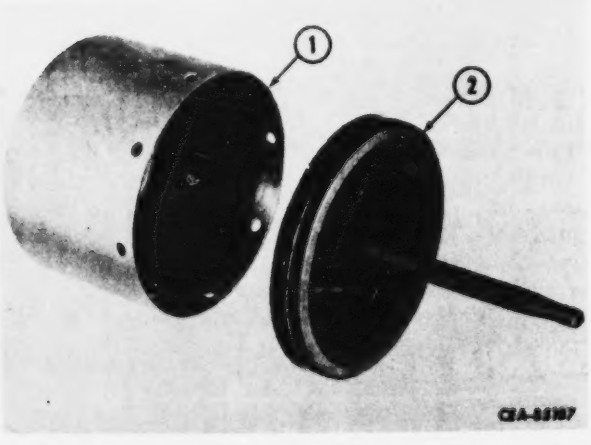


Figure 13-32

Remove air cylinder piston cup (3, Fig. 13-33) and wiper (2) from piston (1).

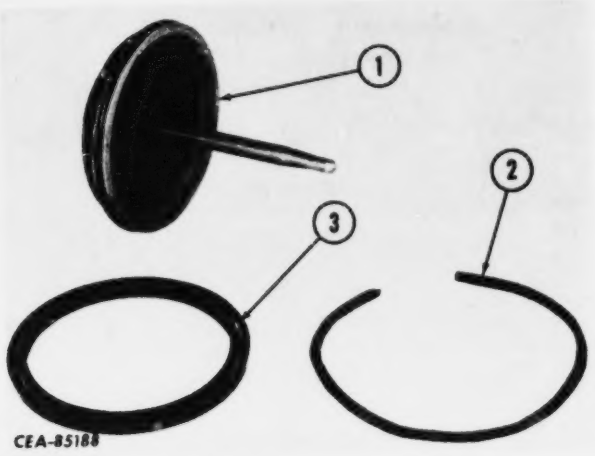


Figure 13-33

Separate piston rod boot (2, Fig. 13-34) from hydraulic cylinder (1).

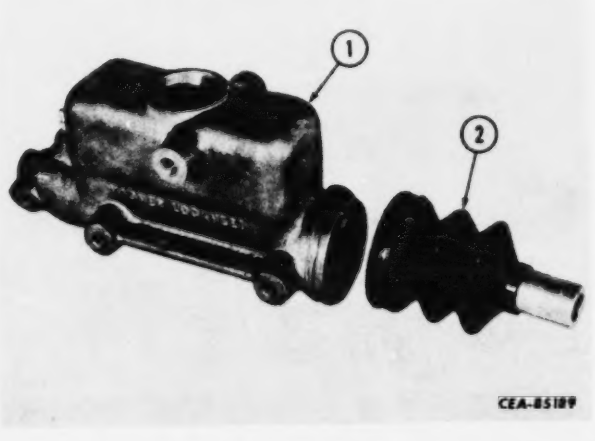


Figure 13-34



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Using a snap ring pliers, remove snap ring (7, Fig. 13-35). Slide piston stop plate (6), piston (5), primary cup (4), and piston return spring (3) out of body (1). Check valve (2) will come out with return spring.

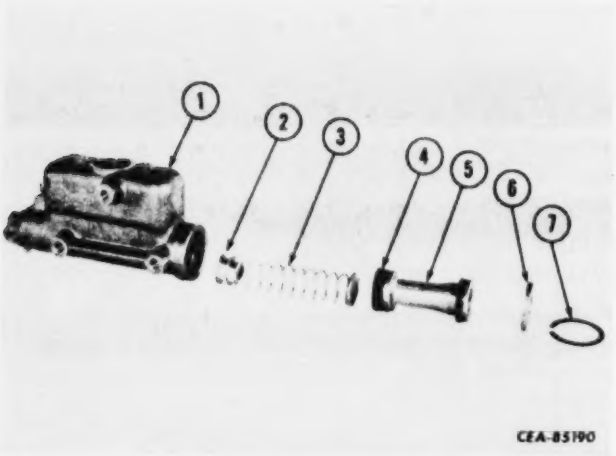


Figure 13-35

Remove secondary cup (1, Fig. 13-36) from piston (2).

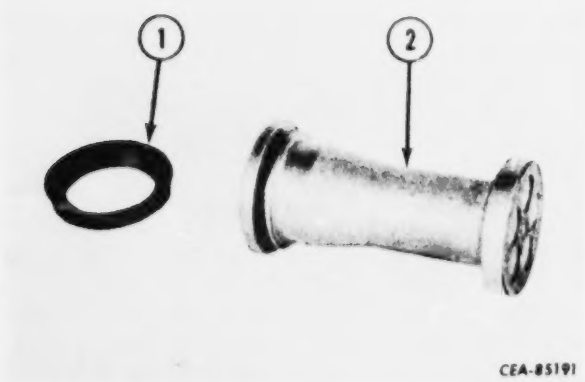


Figure 13-36

Separate check valve and seat (1, Fig. 13-37) and spring (2) from valve retainer (3).

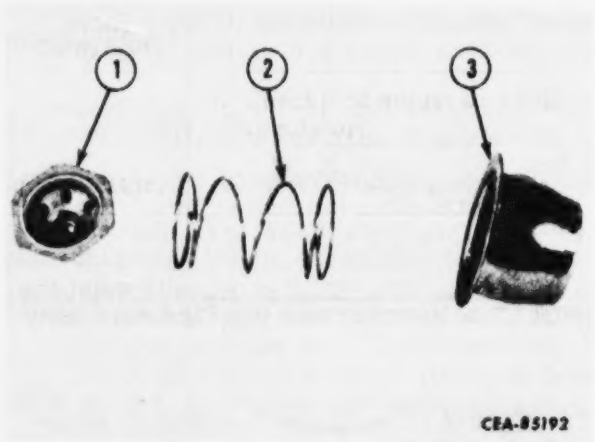


Figure 13-37

### CLEANING AND INSPECTION

Clean and inspect power cluster as follows:

Clean all air cylinder metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

Inspect air cylinder piston cup and felt for wear or deterioration. Replace as necessary.

Clean hydraulic cylinder parts in alcohol.

Inspect hydraulic cylinder bore to be certain it is smooth. It may be necessary to hone cylinder to obtain a smooth finish.

After honing cylinder, wash cylinder in clean alcohol. Be sure that compensating port (smaller hole in bottom of reservoir) is open by inserting a wire through it.

Check filler cap gasket for wear or damage.

Replace screens and filter (or breather) in air cylinder head if necessary. Use a drift to drive old screens and filter out of head. Insert a new inner screen, filter and a new outer screen in head (or thread new breather into head).

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### POWER CLUSTERS - Continued

#### ASSEMBLY

Before assembling hydraulic cylinder parts, they should be dipped in hydraulic brake fluid.

Place spring (2, Fig. 13-37) in valve retainer (3). Insert check valve and seat (1) into retainer.

Install secondary cup (1, Fig. 13-36) on piston (2).

Install check valve assembly (2, Fig. 13-35) in end of piston return spring (3). Insert spring into body (1). Place primary cup (4) on opposite end of the spring. Place spring check valve and cup in body (1). Insert piston (5), cup end first, into body. Install stop plate (6) and snap ring (7).

Attach boot (2, Fig. 13-34) to end of cylinder body (1).

Lubricate air cylinder cup (3, Fig. 13-33) and wiper (2) with light oil and install them on piston and rod assembly (1).

Insert piston and rod assembly (2, Fig. 13-32) into shell (1).

Place piston return spring (2, Fig. 13-31) in shell (1). Insert indicator rod and spring into head (3) and secure temporarily with nut. Insert head (3) into shell and secure with the cap screws and lock washers (4).

Remove nut temporarily holding indicator rod. Place bracket (2, Fig. 13-38) on shell (1) and secure with cap screws and lock washers (3). Reinstall indicator rod nut.

Place hydraulic cylinder (2, Fig. 13-29) in bracket (1). Be certain plunger on air cylinder fits in metal grommet in boot on hydraulic cylinder. Install and tighten mounting studs (3).

Install and tighten cap screws and lock washers (2, Fig. 13-28) that secure hydraulic cylinder (1) to bracket (3).

#### INSTALLATION

Place power cluster on tractor frame and fasten with nuts and lock washers. Connect air line (1, Fig. 13-27) and hydraulic line (2) to power cluster.

If right hand power cluster was removed, connect stop light switch wires.

Fill power cluster reservoir with hydraulic fluid. Bleed hydraulic circuit as described in this section under "BLEED HYDRAULIC BRAKE CIRCUIT."

### ALCOHOL INJECTOR (WHERE USED)

#### REMOVAL

Open drain cock and drain alcohol. Disconnect air inlet and outlet lines from alcohol injector. Remove cap screws, lock washers and nuts securing injector. Remove injector.

#### DISASSEMBLY

Remove cap screws (1, Fig. 13-39). Remove mounting bracket (6) and cover assembly (2). Remove seal (3) from cover and drain (5) from reservoir (4).

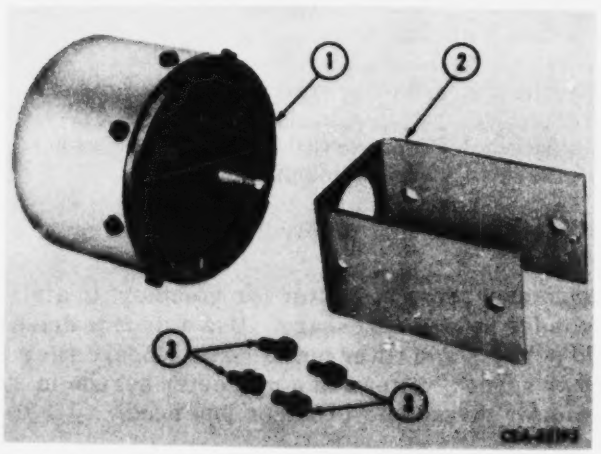


Figure 13-38

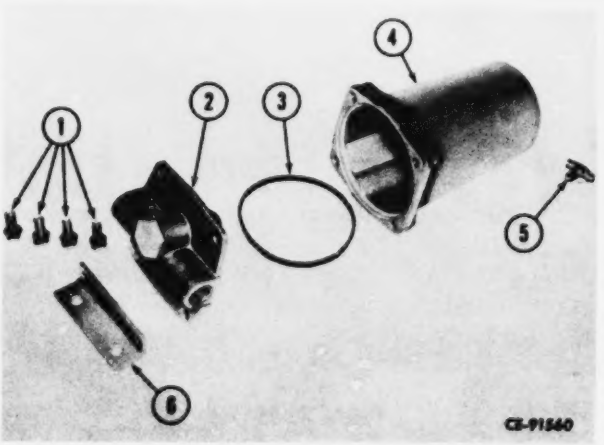


Figure 13-39


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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Using a snap ring pliers, remove retainer (1, Fig. 13-40) and slide spring (2) and valve (3) from cover (6). Use snap ring pliers to remove retainer (12). Slide valve seat (10), valve (9), disc (8) and spring (7) from cover. Unscrew plug (5). Remove seal (4) from plug. Remove "O" ring (11) from seat.

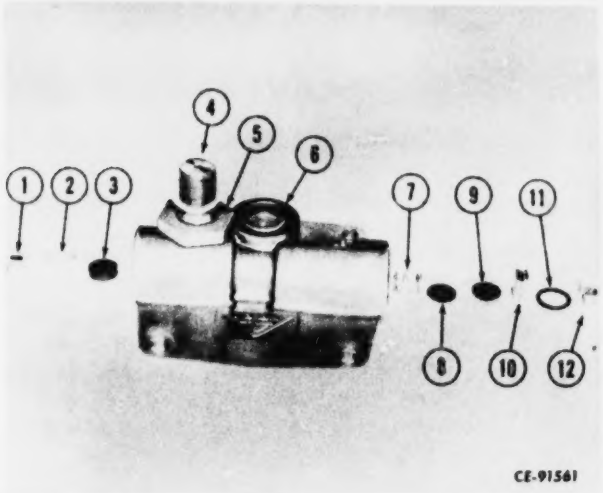


Figure 13-40

### CLEANING AND INSPECTION

Clean and inspect alcohol injector as follows:

Clean all metal parts in a good cleaning solvent. Use compressed air to dry parts.

Inspect all parts for wear or damage.

Replace valves, springs and seals with a service kit.

### ASSEMBLY

Install "O" ring (11, Fig. 13-40) on valve seat (10). Slide the spring (7), disc (8), valve (9) and seat into inlet of cover (6). Secure with retainer (12). Slide valve (3) and spring (2) into outlet of cover. Secure with retainer (1). Install seal (4) on plug (5). Install plug in cover.

Install drain (5, Fig. 13-39) in reservoir (4). Install seal (3) in groove of reservoir. Install cover (2) on reservoir. Position bracket (6) on cover and install cap screws (1).

### INSTALLATION

Position injector on frame and secure with cap screws, lock washers and nuts. Connect air inlet and outlet lines to injector. Fill injector with alcohol.

## AIR COMPRESSOR

### REMOVAL

Drain air system by opening drain valve on air reservoir. Close valve on reservoir when they are empty.

> ◆ CAUTION: BLOCK OR HOLD TRACTOR BY MEANS OTHER THAN SERVICE BRAKES WHENEVER THE AIR SYSTEM IS TO BE DRAINED BELOW 85 PSI.

To drain compressor, drain water from cooling system.

Loosen generator support arm and move generator to relieve tension on drive belt. Slip belt off compressor pulley.

Disconnect all air, water, oil pressure sending unit electrical lead and oil lines connected to compressor.

Remove bolts and lock washers that attach compressor to mounting base and lift compressor from base.

### DISASSEMBLY

Before starting disassembly, remove all grease and dirt from compressor exterior using cleaning solvent and a brush.

Mark following items to show their proper relationships prior to disassembly.

a. Cylinder head's position on crankcase.

b. Position of cylinder block in relation to crankcase.

(Continued on page 21)

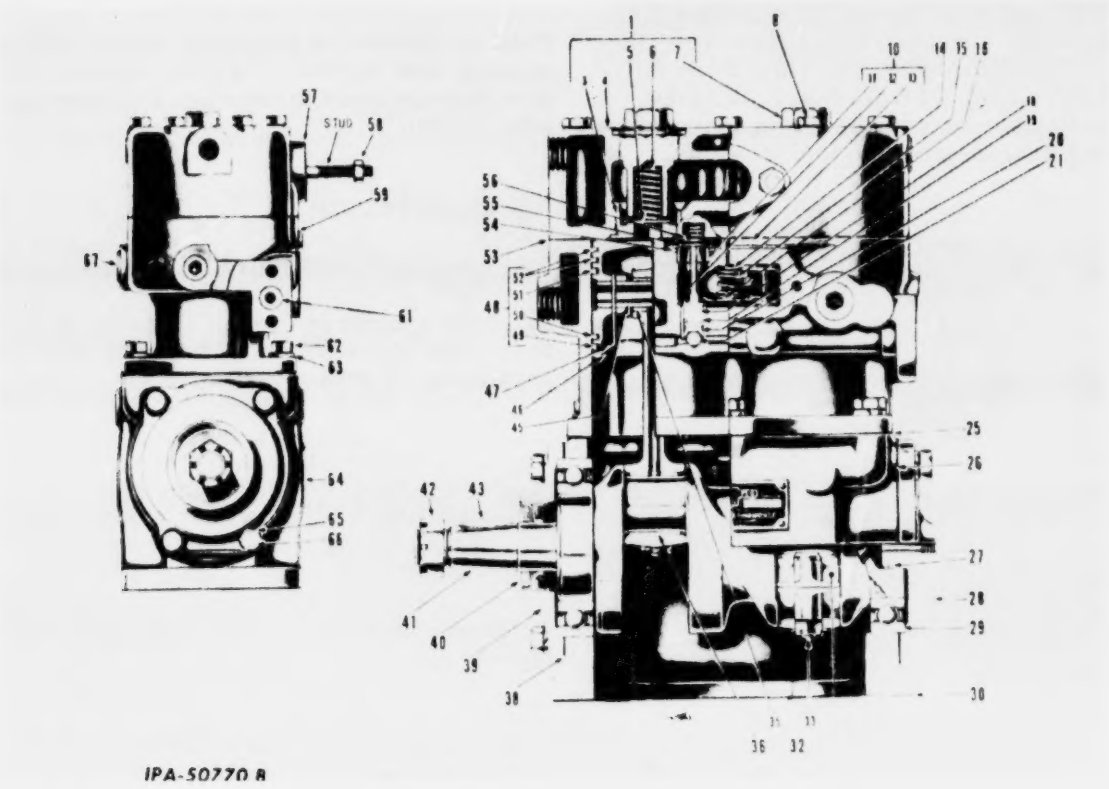


Figure 13-41
Air Compressor (Sectional View).

1. Cylinder head assembly.
3. Discharge valve seat.
4. Cylinder head body.
5. Discharge valve.
6. Discharge valve spring.
7. Discharge valve cap nut.
8. Cap screw.
10. Cylinder block body assembly.
11. Inlet valve seat.
12. Bushing.
13. Cylinder block body.
14. Unloader spring seat.
15. Unloader spring.
16. Unloader spring saddle.
18. Unloader piston.
19. Grommet.
20. Unloader cup.
21. Unloader cup stop.
25. Cylinder block gasket.
26. Rear cover gasket.
27. Oil seal ring.
28. Rear cover.
29. Ball bearing.
30. Flange gasket.
32. Connecting rod and cap assembly.
33. Rod bolt.
35. Wrist pin bushing.
36. Bearing insert.
38. Front cover gasket.
39. Front cover.
40. Oil seal.
41. Crankshaft.
42. Crankshaft nut.
43. Crankshaft key.
45. Wrist pin.
46. Piston.
47. Wrist pin lock wire.
48. Piston ring set.
49. Oil ring.
50. Compression ring.
51. Oil ring.
52. Compression ring.
53. Cylinder head gasket.
54. Inlet valve guide.
55. Inlet valve.
56. Inlet valve spring.
57. Cylinder head fitting gasket.
58. Nut.
59. Strainer gasket.
61. Plug.
62. Cap screw.
63. Lock washer.
64. Crankcase.
65. Lock washer.
66. Cap screw.
67. Plug.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

### AIR COMPRESSOR - Continued

DISASSEMBLY - Continued

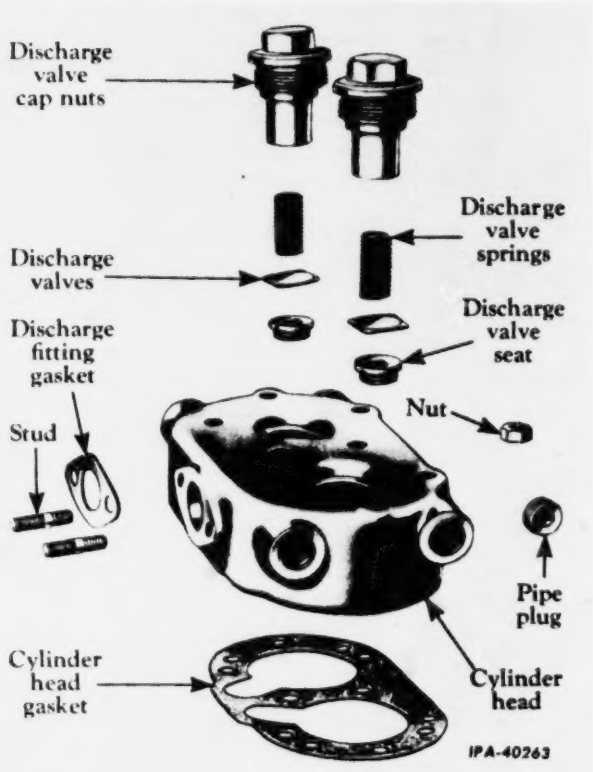


Figure 13-42
Cylinder Block (Exploded).

c. Position of crankcase end covers in relation to crankcase.

d. Position of crankshaft in relation to crankcase.

Remove cap screws (8, Fig. 13-41) and lift off cylinder head. Tap cylinder head with a rawhide hammer to break gasket joint if necessary.

Remove inlet valve springs (56) from head, and inlet valves (55) from their guides in cylinder block (Fig. 13-43).

Scrape off cylinder head gasket from cylinder head and block.

Remove discharge valve cap nuts (7, Fig. 13-41) in cylinder head and lift out discharge valve springs and discharge valves (Fig. 13-42).

Remove nuts and cap screws that secure crankcase cover to bottom of air compressor.

Remove connecting rod bearing caps (32, Fig. 13-41) and push pistons with connecting rods attached out top of cylinder block (Fig. 13-43). Replace caps on each connecting rod. Note that caps are punch marked to show proper position of caps on rods.

Remove piston rings (48, Fig. 13-41) from each piston. If pistons are to be removed from connecting rods, remove wrist pin lock wire (47) and press wrist pin from piston and connecting rod (Fig. 13-43).

Remove drive pulley nut (42, Fig. 13-41) and tap pulley to remove it from keyed crankshaf Remove key (43) from crankshaft.

Remove cap screws securing front cover (39) to crankcase. Slide front cover with oil seal off crankshaft. Do not remove oil seal from cover unless it is to be replaced. Remove cap screws and rear cover (28) with gasket (26) from crankcase.

Press or drive crankshaft with ball bearings out of crankcase from drive end of compressor. Ball bearings can be pressed off crankshaft if necessary to replace them.

Remove cap screws and lock washers (62 and 63) securing cylinder block to crankcase and remove cylinder block and gasket.

Remove unloader valve spring (15), spring saddle (16) and spring seat (14) from cylinder block. Remove unloader guides and plungers, and unloader pistons. If installed, remove unloader cup (20) and stop (21).

Disassembled unloader mechanism should be replaced by an unloader kit.

(Continued on page 23)

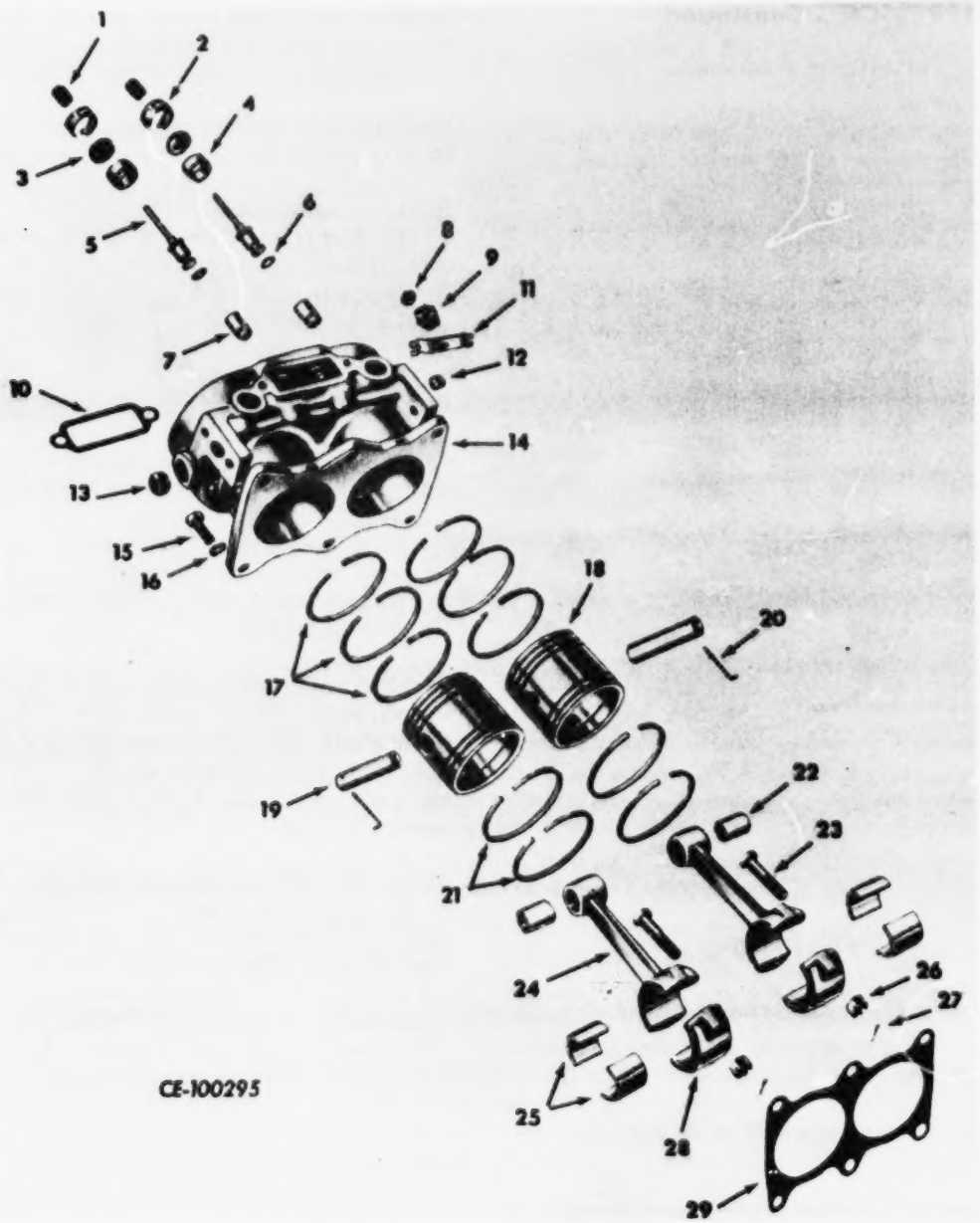


Figure 13-43
Cylinder Block (Exploded View).

1. Inlet valve spring.
2. Inlet valve guide.
3. Inlet valve.
4. Inlet valve seat.
5. Unloader plunger.
6. Grommet.
7. Unloader piston.
8. Unloader spring seat.
9. Unloader spring.
10. Gasket.
11. Spring saddle.
12. Plug.
13. Plug.
14. Cylinder block.
15. Cap screw.
16. Lock washer.
17. Piston rings.
18. Piston.
19. Wrist pin.
20. Wrist pin lock wire.
21. Piston rings.
22. Wrist pin bushing.
23. Connecting rod bolt.
24. Connecting rod.
25. Bearing inserts.
26. Nut.
27. Cotter pin.
28. Rod cap.
29. Cylinder block gasket.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

### AIR COMPRESSOR - Continued

#### DISASSEMBLY - Continued

NOTE: It may be necessary to apply air pressure, with CAUTION, at governor port of cylinder block to remove unloader pistons.

Remove inlet valve seat bushings only if seats are worn or damaged. Refer to "INSPECTION AND REPAIR."

#### CLEAN, INSPECT AND REPAIR

Wash all parts in an oil solvent and dry thoroughly with compressed air.

Put cylinder head through a cleaning solution to remove all carbon from discharge valve cavities and to remove all rust and scale from water cavities. Scrape carbon, dirt and particles of old gaskets from all surfaces.

Clean thoroughly all oil passages through crankshaft, connecting rods, crankcase, base plate and end cover. If necessary, prod oil passages with wire and flush with cleaning solvent.

Put cylinder block through a cleaning solution to remove all carbon and dirt from inlet passages and unloader passages and to remove rust and scale from water cavity. Scrape any particles of old gaskets from all surfaces.

Inspect cylinder head for cracks or breaks. Replace if any are found.

Test water jacket of cylinder head and cylinder block for leakage using air pressure. Replace unit if leakage is found.

Check crankcase, cylinder block and end covers for cracks and broken lugs. Replace if any are found.

Inspect ball bearings for wear or flat spots; replace bearings if these conditions exist. Check ball bearing fit in crankcase. Bearings must be a finger-press fit. If crankcase bearing bores are worn or damaged, crankcase should be replaced.

Inspect inlet valves and seats. If inlet valves are grooved deeper than .003 inch where they contact seat, they should be replaced. Inlet valves not worn excessively or damaged can be reclaimed by lapping them on a piece of crocus cloth on a flat surface. If inlet valve seats show slight scratches or wear, they can be reclaimed by using a lapping stone, grinding compound, lapping disc and valve grinding tool. If seats cannot be reclaimed in this manner, they should be replaced. The dimension from top of cylinder block to inlet valve seat should not exceed 0.145 inch nor be less than 0.101 inch. After installing new seats, dimension should be 0.101 to 0.113 inch.

Discard old discharge valve springs and replace with new springs. Inspect discharge valves and discharge valve seats. If the discharge valves are grooved deeper than .003 inch where they contact seats, they should be replaced. If valves are not worn excessively, they can be cleaned by lapping them on a piece of crocus cloth on a flat surface. If seats are worn excessively with insufficient metal left for lapping stone, the seats should be replaced. If new discharge valves, springs and cap nuts are installed, the discharge valve travel should be between .056-.070 inch.

Test discharge valves for leakage by applying 100 pounds of air pressure through discharge port of cylinder head and applying soap suds to discharge valve openings in floor of cylinder head. Leakage should not exceed a one-inch soap bubble in not less than five seconds (Fig. 13-44).

(Continued on next page)

Figure 13-44
Testing Discharge Valve for Leakage.

## AIR COMPRESSOR - Continued

### CLEAN, INSPECT AND REPAIR - Continued

If excessive leakage is found, leave air pressure applied and, using a fiber or hardwood dowel and light hammer, tap discharge valves off their seats several times to improve seal between valves and their seats. If valves and seats have been reconditioned properly, this will reduce leakage (Fig. 13-45).

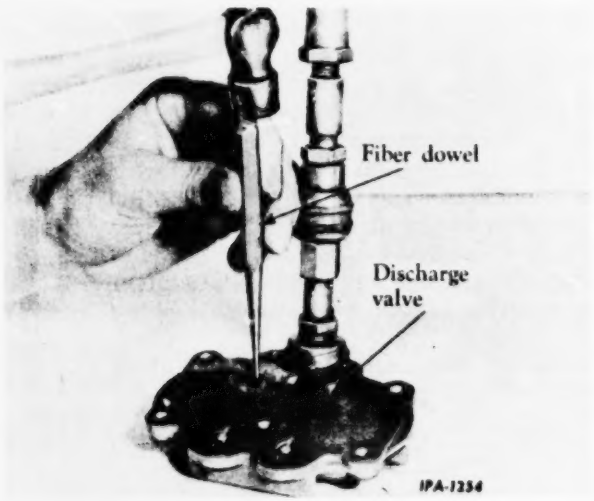


Figure 13-45
Seating Discharge Valve with Dowel.

Leakage tests must also be made by applying soap suds around the discharge valve cap nuts with air pressure applied as previously outlined. Leakage at cap nuts is not permissible.

Check the cylinder bores for evidence of excessive wear, out-of-round or scoring. Cylinder bores which are scored or out-of-round more than .002 inch or tapered more than .003 inch should be rebored or honed oversize. Cylinder bores should be finished honed while bolted to the compressor crankcase if possible. Oversize pistons (.010, .020 and .030) are available. Cylinder bores must be smooth, straight and round.

Inspect pistons for scores, cracks or damage of any kind. If scores or cracks are found, replace the piston.

Check clearance between pistons and cylinder bores with feeler gauge stock (Fig. 13-46). Clearance should be between .002 inch minimum and .004 inch maximum.

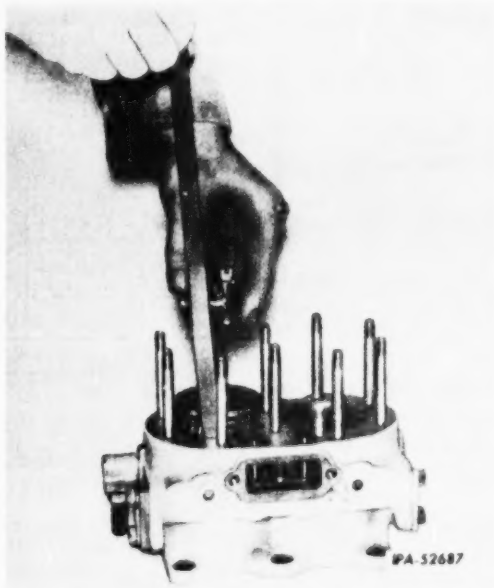


Figure 13-46
Checking Piston and Cylinder Bore Clearance.

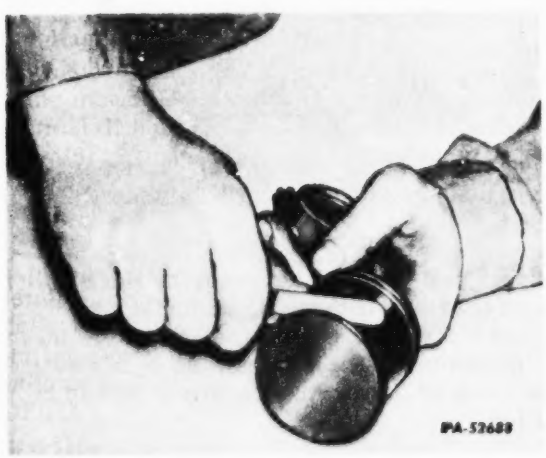


Figure 13-47
Checking Piston Ring Groove Clearance.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Check pistons for correct clearance between rings and ring grooves (Fig. 13-47). Also check ring gap with rings installed in cylinder bores (Fig. 13-48).

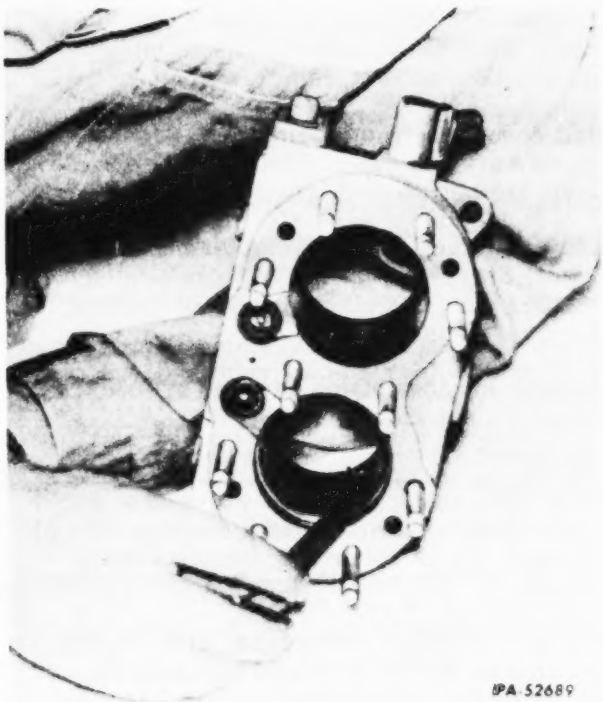


Figure 13-48
Checking Piston Ring Gap.

Correct ring gap and groove clearance is shown in (Fig. 13-49).

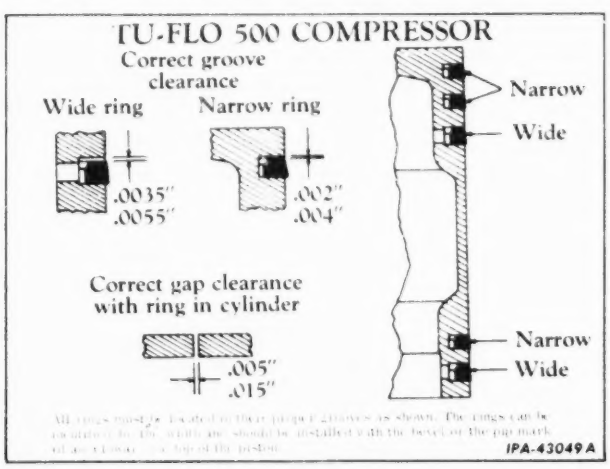


Figure 13-49
Position and Clearance of Piston Rings.

Check fit of wrist pins in pistons and connecting rods. Wrist pins must be a light press fit in pistons. If wrist pin is a loose fit, wrist pin, piston or both must be replaced. Check fit of wrist pin in connecting rod bushing by rocking piston. Clearance of wrist pin-to-connecting rod bushing should not exceed .0015 inch. If excessive clearance is apparent, replace wrist pin bushings in connecting rods.

When pressing new bushings into place, be sure oil hole in bushing lines up with oil hole in connecting rod. Bushings must then be reamed, honed or bored to provide between 0.0001 and 0.0006 inch clearance between bushing and wrist pin.

Inspect connecting rod bearings for proper fit on crankshaft journals. Check connecting rod bearings for wear. If worn, cracked or broken, inserts must be replaced. Connecting rod caps are not interchangeable. Position caps so the two insert locking slots are adjacent to the same cap screws.

Crankshaft journals which are more than 0.001 inch out-of-round or bruised must be reground. When regrinding, fillets at the ends of journals must be maintained. Undersize connecting rod bearing inserts (0.010, 0.020 and 0.030) are available for reground crankshafts.

Main bearing journals must not be worn sufficiently to prevent ball bearings being a snug fit.

Oil seal ring grooves in crankshaft must not be worn sufficiently to prevent a good fit on oil seal rings. Walls of the oil seal ring grooves must be square and have a good finish.

### ASSEMBLY

Place a new cylinder block gasket (25, Fig. 13-41) in position on the crankcase. Position cylinder block on crankcase according to markings made prior to disassembly. Install cap screws and tighten securely.

If removed, press ball bearing (29) onto each end of crankshaft. Install front cover (39) with a new oil seal (40) and a new gasket (38) to the crankcase. Carefully insert threaded end of crankcase through oil seal (40). Press the

(Continued on next page)

## AIR COMPRESSOR - Continued

ASSEMBLY - Continued

crankshaft bearings into crankcase from rear of compressor, being sure front main bearing bottoms against front cover.

Install a new oil seal ring (27) in rear cover (28). Place a new cover gasket (26) on crankcase, so oil holes in gasket and crankcase line up. Install rear cover to align with oil holes. Tap cover into place and secure with cap screws.

Position connecting rod in piston and press wrist pin into piston with lock wire holes in pin aligned with lock wire holes in piston.

Install new wrist pin lock wire in wrist pin so long end extends through piston and wrist pin. Snap short end into lock wire hole near bottom of piston skirt (Fig. 13-50).

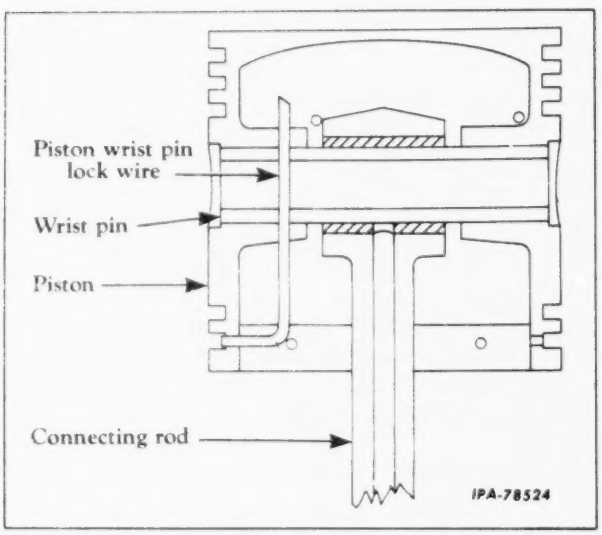


Figure 13-50
Method of Installing Wrist Pin Lock Wire.

Install piston rings in their proper location and, with pip marks or bevel up (Fig. 13-49), stagger piston ring gaps so they are not in line.

Before installing pistons and connecting rods, thoroughly lubricate pistons, piston rings, wrist pin bushings and connecting rod bearings with clean engine oil.

Turn crankshaft so as to position one crankshaft journal downward. Remove bearing cap from one connecting rod, leaving connecting rod bolts in rod.

Using a ring compressor, install connecting rod and piston through top of cylinder whose journal is down. Push piston down until connecting rod bearing makes contact with crankshaft journal.

Install connecting rod bearing cap. Be sure aligning marks on cap and rod coincide. If cap and rod are not marked, position cap on the rod so two locking slots in bearing inserts, rod and cap are both located adjacent to same connecting rod bolt. Secure cap to rod with castellated nuts and cotter pins. Install remaining connecting rod and piston in same manner.

Lubricate unloader piston bores in cylinder block with clean engine oil.

NOTE: New unloader pistons in replacement kit are already lubricated with a special lubricant. Do not remove this lubrication.

Install new unloader pistons (18, Fig. 13-41) lubricated as received, in their bores using caution against cutting piston "O" rings or distorting spiral back-up rings. Position unloader plungers in their guides and slip them in over tops of pistons (Fig. 13-43).

Install unloader spring seat (14, Fig. 13-41) in cylinder block; a small hole is drilled in block for this purpose. Position saddle (16) between unloader piston guides so its forks are centered on guides (Fig. 13-43). Install unloader spring (15, Fig. 13-41), being sure it seats over the spring seats both in block and on saddle.

Install inlet valve seats (11) if they were removed from cylinder block. Position and install inlet valve guides (54); then drop inlet valves (55) into their guides. There should be a loose sliding fit between guides and valves.

If removed, install discharge valve seats (3). Install discharge valves, springs and valve cap nuts in cylinder head.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Place inlet valve springs (56) in cylinder head. Use a small amount of grease to keep them from falling out when head is inverted to install it on cylinder block. Place a new cylinder head gasket on block. Carefully align inlet valve springs with inlet valve guides in cylinder block as head is placed on cylinder block. Secure cylinder head to block with cylinder head bolts. Tighten bolts evenly.

Install crankcase bottom cover using a new gasket.

Install key and drive pulley to crankshaft; add and tighten nut (42), and lock with cotter pin.

### TESTING REBUILT COMPRESSOR

In order to properly test a compressor under operating conditions, a test bench similar to the one shown in Fig. 13-51 is necessary for properly mounting, cooling, lubricating and driving the compressor. If such facilities are available, the oil supply line must furnish at least 15 psi during all tests and the crankcase kept drained of oil during the tests. A water circulating system must be provided. Such tests are not compulsory, if the unit has been carefully rebuilt.

RUN-IN TEST: Run compressor for one half hour at 1750 rpm with compressor discharge port open to atmosphere. Check during run for oil leaks, overheated bearings and excessive noise.

EFFICIENCY TEST: This test is made by running compressor for one half hour at 1750 rpm connected to a reservoir fitted with an orifice type exhaust fitting. Size of orifice in this fitting should be .089 inch. Compressor should maintain a minimum pressure of 75 psi in reservoir during this test. For this test, valves No. 1 and No. 4 should be closed and valve No. 2 opened (Fig. 13-51).

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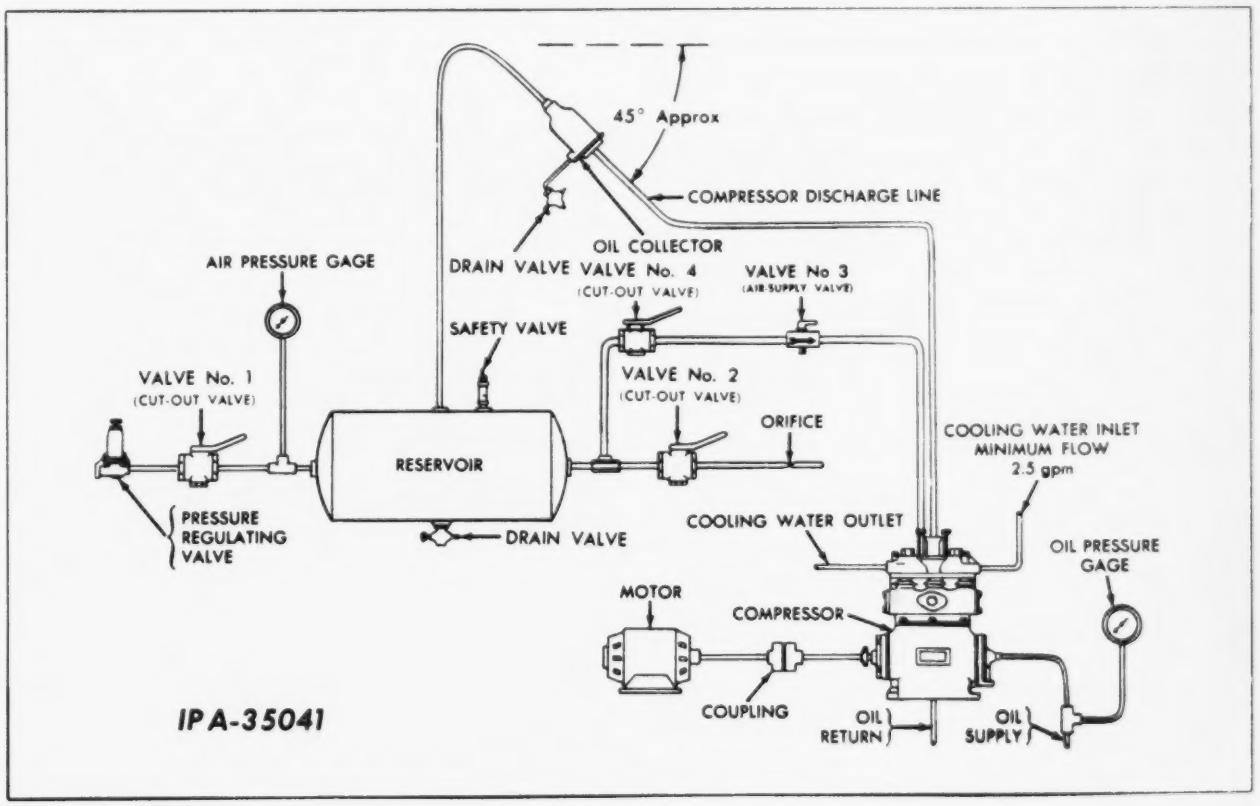


Figure 13-51
Sketch of Test Bench for Compressor.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### AIR COMPRESSOR - Continued

#### TESTING REBUILT COMPRESSOR - Continued

COMPRESSOR UNLOADING MECHANISM TEST: A test to check compressor unloading mechanism can be made by closing valves No. 1 and No. 2 and opening valve No. 3 and No. 4. Run compressor until unloading mechanism operates, stopping further compression of air. This should occur at an air pressure not greater than 105 psi as noted on reservoir air pressure gauge.

#### INSTALLATION

Install compressor on mounting bracket. Insert base stud bolts through four slotted holes in bracket plate. Be sure adjustment bolt strap is behind both mounting legs. Add lock washers and nuts to stud bolts but do not tighten.

Slip belt into drive pulley groove. Install a new drive belt if necessary. Align pulleys and tighten mounting hardware securely.

Connect all air, water and oil lines to compressor.

Adjust drive belt for correct tension.

Close radiator water drain valve and fill cooling system. Close drain valve for air reservoir.

Start engine and check compressor for air, oil and water leaks.

### WHEEL BRAKES

#### REMOVAL

Disconnect hydraulic lines from wheel cylinder. Disassemble axle as far as necessary to remove assembled brake and spider. Remove cap screws and lock nuts that secure brake spider to axle housing.

#### DISASSEMBLY

Remove bleeder screw (3, Fig. 13-52) from wheel cylinder (4). Drain hydraulic brake fluid from cylinder. Loosen setscrew (2) that holds wheel cylinder in position. Unscrew wheel cylinder from spider (1).

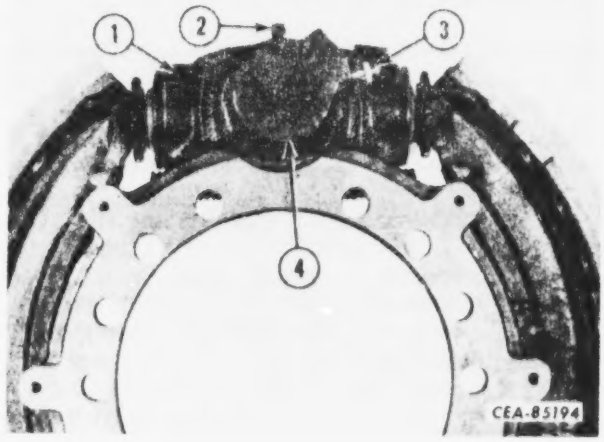


Figure 13-52

Shake or slide piston (5, Fig. 13-53) out of cylinder (1). Remove cup (4), plug (3), and spring (2). Remove "O" ring (6) from piston.

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## DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove wedge and roller assembly from brake spider (Fig. 13-54).

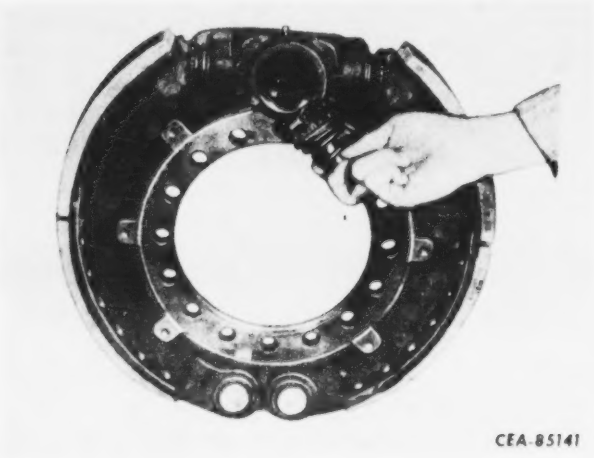


Figure 13-54

Compress spring (4, Fig. 13-55) and remove E-washer (6) and flat washer (5). Slide spring (4) and washer (3) off wedge (1). Remove rollers (7) from cage (2) and slide wedge out of cage (spread height of cage with screwdriver to remove rollers).

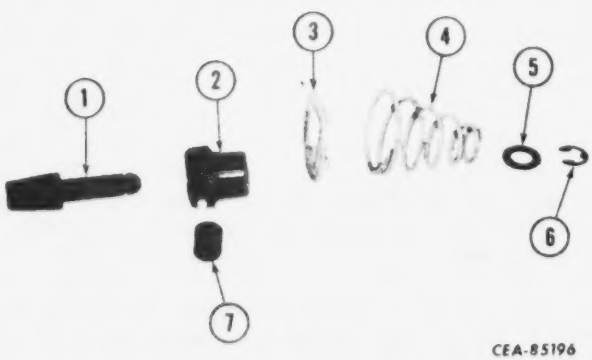


Figure 13-55

Remove brake shoe return spring (1, Fig. 13-56). Remove retaining springs (2) from anchor pins (5). Remove felt retainer (3) and felt (4). Slide anchor pins (5) out of spider and shoes. Remove shoe and lining assemblies (6).

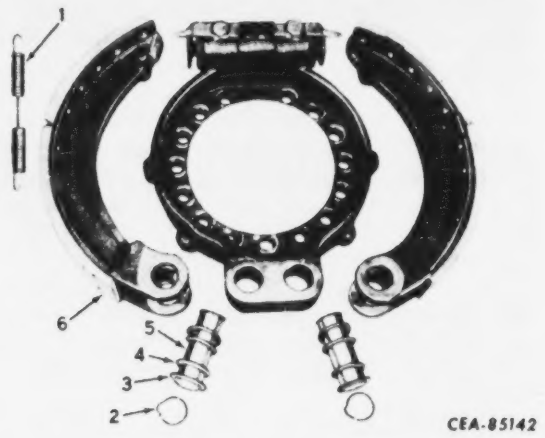


Figure 13-56

Bend back lock (2, Fig. 13-57) and remove cap screw (1). Remove lock and detent (3). Remove adjustment bolt (7) from plunger (5). Remove seal (6) and plunger (5) from plunger housing.

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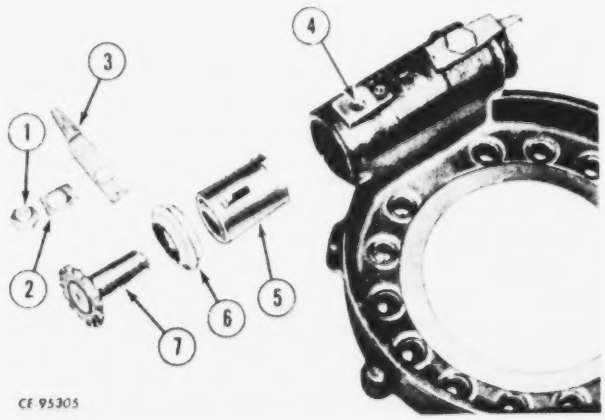


Figure 13-57

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### WHEEL BRAKES - Continued

#### CLEANING AND INSPECTION

Clean and inspect brake assembly parts as follows:

a. Clean all metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

b. Inspect wheel cylinder cup and plug for signs of wear or cracking. Replace any defective parts.

c. Inspect wheel cylinder for scoring or damage. Hone cylinder if scored.

d. Inspect parts of wedge and roller assembly and plunger assembly for signs of wear or damage. Replace any defective parts.

e. Inspect plunger seal. Replace if defective.

f. Inspect anchor pins for wear or misalignment. Inspect brake shoes for wear at anchor pin holes. Replace anchor pin felts and retaining springs.

Lubricate internal actuating parts of brake assembly (wedge assembly, guide screws, plunger, and actuator cavity) with multi-purpose NLGI, Grade 2 lithum base chassis grease (IH 251H EP) before assembly.

Dip wheel cylinder cup, piston, and piston seal ring in hydraulic brake fluid before assembly.

Reline brake shoe assemblies as described below.

#### BRAKE RELINING

Punch out rivets and remove old linings from shoes. Clean lining and shoe contact faces. Clamp lining to the shoe with C-clamps so holes in both pieces are in alignment.

Rivets of correct body diameter, head size and shape, length, and material must be used.

Using a rivet press, install rivets following sequence shown in Fig. 13-58.

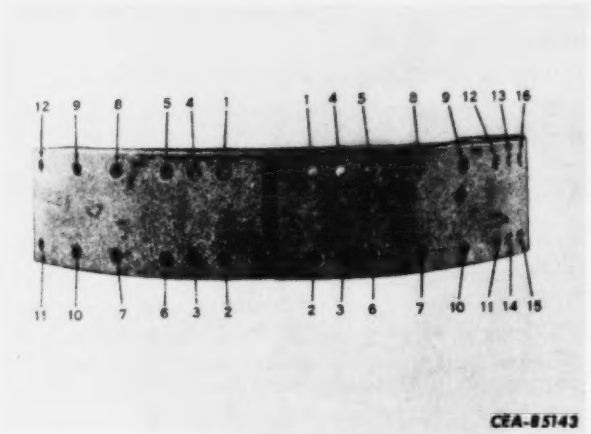


Figure 13-58

Check lining installation with a 0.002-inch feeler gauge to assure proper lining and shoe contact.

#### ASSEMBLY

Insert plunger (5, Fig. 13-57) into seal (6) until inner lip of seal enters groove in plunger. Slide plunger into housing, aligning groove in plunger with guide screw hole (4) in housing. Seat seal on housing. Place detent (3) and lock (2) on housing and install and tighten guide screw (1). Lock in place by bending lock against screw. Screw bolt (7) into plunger.

Position brake shoe and lining assemblies (6, Fig. 13-56) on spider. Position a felt (4) and felt retainer (3) on each anchor pin (5). Insert anchor pins through holes in spider and shoes. Place a felt and felt retainer on each pin. Secure pins with retaining rings (2). Install a new brake shoe return spring (1).

Insert wedge (1, Fig. 13-55) into roller cage (2). Install rollers (7) in cage. Place washer (3), spring (4), and washer (5) on wedge shaft. Compress spring and install E-washer (6) in groove in wedge shaft.

Install assembled wedge and roller assembly in spider. Be certain that rollers enter slots in plungers. (Fig. 13-54.)

Install "O" ring (6, Fig. 13-53) on piston (5). Slide spring (2), plug (3), cup (4) and piston into cylinder (1).

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Screw wheel cylinder (4, Fig. 13-52) into spider (1) until it bottoms. If bleeder and brake line holes are not in desired position, unscrew cylinder to align as desired. This will require less than one full turn. Install and tighten setscrew (2) to 175-200 in. lbs. Loosen setscrew and torque to 50 in. lbs.

NOTE: Over-tightening may distort cylinder housing.

Install bleeder screw (3) in cylinder.

### INSTALLATION

Install brake and spider assembly. Secure with cap screws and lock washers. Tighten cap screws to recommended torque (Refer to "SPECIAL TORQUES").

Torque:_____

Connect hydraulic lines to wheel cylinder. Assemble axle components. Bleed hydraulic brake circuit. Adjust brake lining to drum clearance as described under "ADJUST BRAKES."

### BLEED HYDRAULIC BRAKE CIRCUIT

The hydraulic portion of each power cluster and wheel brake assembly must be "bled" when it is suspected that air is present in brake fluid, such as after overhaul.

Manually bleed hydraulic lines of a power cluster as described below:

a. Start and run engine to charge compressed air portion of brake system. Shut down engine.

b. Remove fill cap and fill power cluster reservoir with type fluid recommended in "SPECIFICATIONS." Keep reservoir full during entire bleeding operation.

c. Attach a bleeder hose, if available, to bleeder screw at power cluster. Submerge opposite end of hose in a jar partially filled with brake fluid.

d. Open bleeder screw one turn and slowly apply one of treadle valves. Make additional treadle applications until no bubbles escape from bleeder hose. If a bleeder hose is not used, close bleeder screw each time before releasing treadle valve.

e. Close bleeder screw and remove bleeder hose. Then bleed hydraulic cylinders on wheels. Fill cylinder reservoir to within 1/2" to 3/8" of fill hole.

## BRAKE LINES AND ACCESSORIES

### GENERAL

Brake air and hydraulic lines should be inspected periodically for signs of wear or damage. Inspect tube fittings for leakage. Replace any lines or fittings found to be defective. Care should be taken when installing brake lines that they are not crimped or bent too sharply.

## PARKING BRAKE

### GENERAL

Prepare tractor for disassembly of parking brake as follows:

a. Park tractor on a level surface.

b. Install safety pins to lock tractor halves in a full turn position. Refer to tractor operator's manual for safety pin installation instructions.

c. Block tractor wheels to prevent tractor from rolling.

(Continued on next page)

## PARKING BRAKE - Continued

### REMOVAL

Remove cap screws (3, Fig. 13-59) that secure transmission-to-transfer drive shaft (4) to transfer drive yoke (1). Remove drive shaft from yoke.

Disconnect parking brake linkage (2) from operating cam lever.

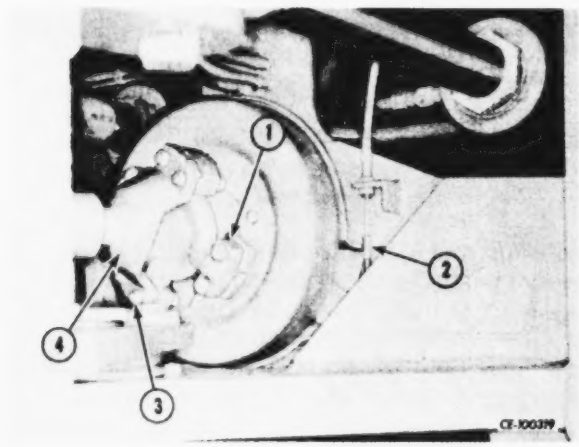


Figure 13-59

### DISASSEMBLY

Remove lock nut (1, Fig. 13-60), retainer (2), and seal washer (3) that secure yoke and drum assembly (4) to transfer drive shaft (5).

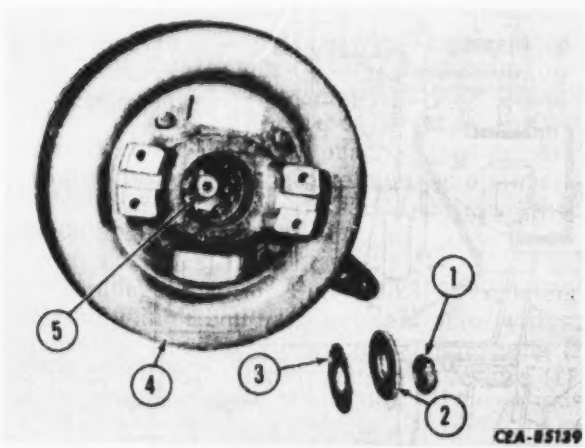


Figure 13-60

Remove yoke and drum assembly.

Remove cap screws and lock nuts (1, Fig. 13-61) that secure drum (2) to yoke (3). Separate drum and yoke.

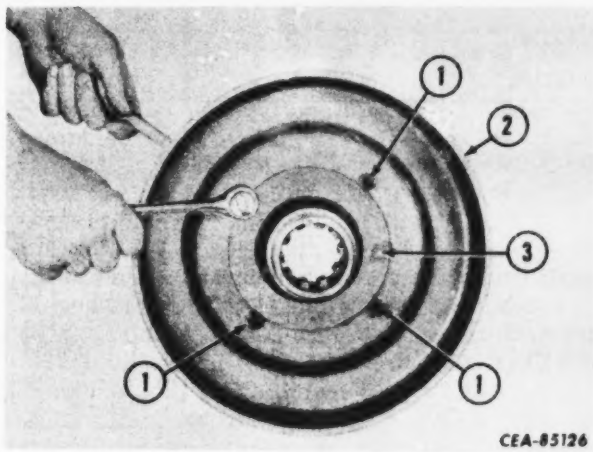


Figure 13-61

Using a brake spring pliers, remove brake springs (1, Fig. 13-62) from brake shoes (2) as shown.

Remove brake shoes from backing plate.

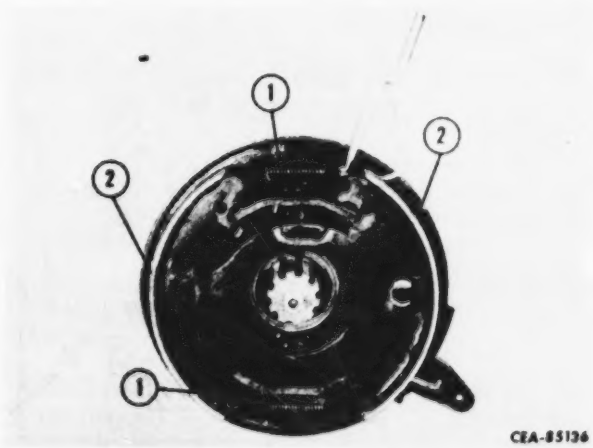


Figure 13-62

## DISASSEMBLY, INSPECTION AND ASSEMBLY

Remove operating cam lever (2, Fig. 13-63) and roller (1) from pawls (3 and 4) on backing plate.

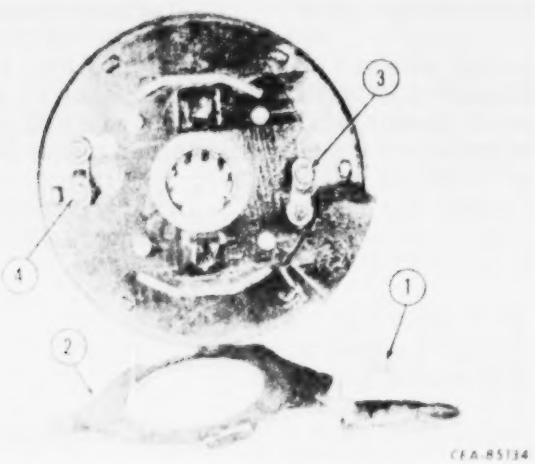


Figure 13-63

Remove cap screws and lock washers (1, Fig. 13-64) that secure backing plate (2) to transfer drive housing.

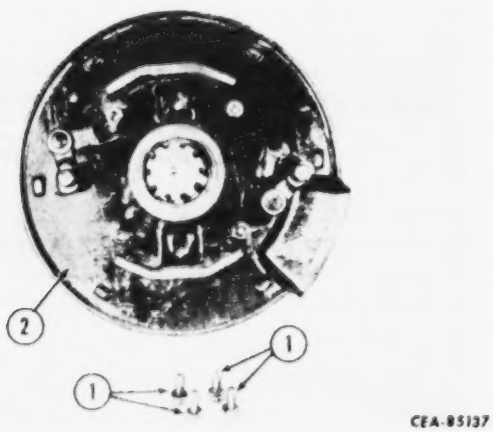


Figure 13-64

### CLEANING AND INSPECTION

Clean and inspect all parts as follows:

a. Inspect brake linings and drum for wear. Replace worn linings as described under "BRAKE RELINING."

b. Clean all parts in solvent. Use compressed air to dry parts.

c. Lubricate actuating parts of brake (operating cam lever, roller, pawls) with chassis grease.

d. Inspect parking brake parts for signs of wear or damage. Replace any parts found to be defective.

### BRAKE RELINING

Reline parking brake shoes as follows:

a. Punch out rivets and remove old lining from the shoe.

b. Clamp new lining to shoe so that rivet holes in both pieces are in alignment. Use a "C" clamp and locate it as near rivet holes as possible.

NOTE: Lining and shoe contact faces should be clean before assembling. Rivets of the correct size and shape must be used.

c. Using a rivet press, install rivets following sequence shown in Fig. 13-65.

(Continued on next page)

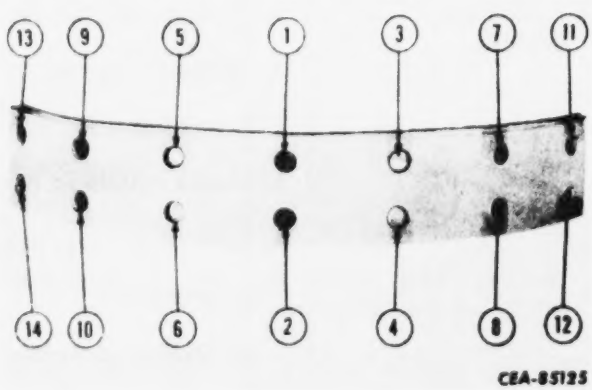


Figure 13-65

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### PARKING BRAKE - Continued

#### ASSEMBLY

Install backing plate (2, Fig. 13-64) on transfer drive housing and secure with cap screws and lock washers (1). Tighten cap screws to recommended torque (Refer to "SPECIAL TORQUES").

Torque: _____

Place roller (1, Fig. 13-63) on pawl (3) on backing plate. Install operating cam lever (2) on left pawl (3) and under roller (1).

Install brake shoes (2, Fig. 13-62) on backing plate. Install brake springs (1) on shoes using a brake spring pliers. Be sure springs are installed in rear holes.

Place yoke (3, Fig. 13-61) in drum (2) and secure with cap screws and lock nuts (1). Tighten lock nuts to recommended torque (Refer to "SPECIAL TORQUES").

Torque: _____

Install yoke and drum assembly (4, Fig. 13-60) on shaft (5). Place a new seal washer (3) on shaft. Install retainer (2) and a new lock nut (1). Tighten lock nut to recommended torque (Refer to "SPECIAL TORQUES").

Torque: _____

#### INSTALLATION

Connect parking brake linkage (2, Fig. 13-59) to operating cam lever.

Install drive shaft (4) in yoke (1) and secure with cap screws (3).

Adjust parking brake linkage as described under "PARKING BRAKE LINKAGE" in "LINKAGE" section.

## TROUBLE SHOOTING

### GENERAL

The chart below contains trouble shooting information for the brake system. Each trouble or symptom listed is followed by the possible cause(s) and suggested remedy or remedies. The chart should be used as an aid in the isolation and correction of brake system problems.

| COMPLAINT | POSSIBLE CAUSE | REMARKS |
|---|---|---|
| Inadequate braking. | 1. Brakes need adjusting.<br>2. Brake linings worn.<br>3. Low fluid level in power clusters.<br>4. Wheel cylinders defective.<br>5. Low air system pressure due to:<br>a. Air leaks.<br>b. Faulty governor.<br>c. Faulty compressor. | |

## TROUBLE SHOOTING

| COMPLAINT | POSSIBLE CAUSE | REMARKS |
|---|---|---|
| Inadequate braking. (Cont) | 6. Brake treadle valve delivery pressure too low.<br>7. Defective power cluster.<br>8. Restricted air or hydraulic lines. | 6. Clean, repair or replace treadle valve. |
| Brakes apply too slowly. | 1. Brakes need adjusting.<br>2. Low air pressure in brake system.<br>3. Brake treadle valve delivery pressure is too low.<br>4. Leakage in air system.<br>5. Restricted air or hydraulic lines. | 3. Clean, repair or replace treadle valve. |
| Brakes will not apply. | 1. No air pressure in brake system.<br>2. Defective brake treadle valve.<br>3. Defective power cluster.<br>4. Defective wheel cylinders.<br>5. Low fluid level in power cluster. | |
| Brakes release too slowly. | 1. Brake shoe return springs broken.<br>2. Defective wheel cylinders.<br>3. Brake treadle valve not returning to fully released position.<br>4. Brake treadle valve exhaust port plugged.<br>5. Defective power cluster.<br>6. Restricted air or hydraulic lines. | 3. Clean, lubricate, or repair treadle valves. |
| Brakes do not release. | 1. Brake shoe return springs broken.<br>2. Defective wheel cylinders.<br>3. Brake treadle valve not returning to fully released position.<br>4. Defective power cluster.<br>5. Restricted air or hydraulic lines. | 3. Clean, lubricate, or repair treadle valves. |

(Continued on next page)

## GENERAL - Continued

| COMPLAINT | POSSIBLE CAUSE | REMARKS |
|---|---|---|
| Brakes grab when applied. | 1. Grease on lining.<br>2. Brake drum out of round.<br>3. Defective brake treadle valve. | 1. Reline brakes. |
| Brakes pull when applied. | 1. Brakes need adjusting.<br>2. Low fluid level in power clusters.<br>3. Brake linings worn.<br>4. Defective wheel cylinders.<br>5. Grease on brake lining.<br>6. Brake return spring broken.<br>7. Defective power cluster.<br>8. Brake drum out of round. | 5. Reline. |
| Air pressure will not rise to normal reading. | 1. Defective air pressure gauge.<br>2. Excessive leakage in air system.<br>3. Air reservoir drain open.<br>4. Governor out of adjustment.<br>5. Defective compressor. | |
| Air pressure rises to normal reading too slowly. | 1. Excessive leakage in air system.<br>2. Engine speed too slow.<br>3. Compressor discharge valves leaking.<br>4. Defective compressor.<br>5. Excessive carbon in compressor discharge line or cylinder head. | |
| Air pressure rises above normal reading. | 1. Defective air pressure gauge.<br>2. Governor out of adjustment.<br>3. Defective governor. | |

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## TROUBLE SHOOTING

| COMPLAINT | POSSIBLE CAUSE | REMARKS |
|---|---|---|
| Air pressure rises above normal reading. (Cont) | 4. Restricted line from governor and compressor unloading mechanism.<br>5. Compressor unloading cavities and passages blocked with carbon. | |
| Air pressure drops too quickly with engine stopped and brakes released. | 1. Leaking brake treadle valve.<br>2. Leaking hoses or lines.<br>3. Compressor discharge valve leaking.<br>4. Governor leaking. | |
| Air pressure drops too quickly with engine stopped and brakes applied. | 1. Leaking power cluster.<br>2. Leaking brake treadle valve.<br>3. Leaking hoses or lines. | |
| Noisy compressor. | 1. Worn bearings.<br>2. Excessive carbon deposits in compressor.<br>3. Inadequate lubrication.<br>4. Compressor worn excessively. | 3. Check oil supply line. |
| Safety valve "blows off." | 1. Safety valve adjustment.<br>2. Air pressure in system too high. | |
| Excessive water or oil in system. | 1. Defective moisture ejector valve.<br>2. Compressor passing excessive oil. | |

## PARKING BRAKE

| | | |
|---|---|---|
| Lever will not operate. | 1. Incorrect linkage or lever adjustment.<br>2. Lever joints frozen or binding.<br>3. Brake mechanism frozen or rusted. | |
| Brake will not hold. | 1. Incorrect linkage or lever adjustment.<br>2. Broken linkage.<br>3. Broken drum.<br>4. Defective brake mechanism. | |

## SPECIFICATIONS

GOVERNOR

| | |
|---|---|
| Pressure Range | 90 psi to 105 psi |

SAFETY VALVE

| | |
|---|---|
| Pressure Setting | 150 psi ± 5 psi |

WHEEL BRAKES

| | |
|---|---|
| Type | Two shoe, Internal Expanding |
| Diameter | 20-1/4 in. |
| Liner Width | 4 in. |

AIR COMPRESSOR

| | |
|---|---|
| Capacity at 1250 rpm | 12 C. F. M. |
| Bore | 2-1/2 in. |
| Stroke | 1-11/16 in. |

ALCOHOL INJECTOR

| | |
|---|---|
| Refill fluid | methyl alcohol |



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## SERVICE INFORMATION

### LUBRICANT

| | |
|---|---|
| Hydraulic Brake Fluid | IH Heavy Duty or J-1703a |

### TOLERANCES

AIR COMPRESSOR

| | |
|---|---|
| Discharge valve travel | .056"-.070" |
| Piston-to-cylinder bore clearance | .002"-.004" |
| Wrist pin-to-connecting rod bushing clearance | .0001"-.0006" |
| Max. permissible crankshaft journal out-of-round before reconditioning | .001" |
| Ring gap in cylinder bore | .005"-.015" |
| Ring fit in grooves: | |
| Narrow ring | .002"-.004" |
| Wide ring | .0035"-.0055" |
| Max. permissible clearance in connecting rod bushing before replacing | .0015" |
| Connecting rod bearing clearance | .0003"-.0021" |
| Clearance between top of inlet valve seat and cylinder block | .101"-.145" |

### SPECIAL TORQUES

| | |
|---|---|
| Brake mounting cap screws | 177 ft-lbs. |
| Parking brake backing plate-to-cover cap screws | 53-60 ft-lbs. |
| Parking brake drum lock nuts | 36 ft-lbs. |
| Transfer drive shaft nut | 200 ft-lbs. |

## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
|---|---|---|---|
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# SECTION XIV
# SHIFT MODULATOR SYSTEM

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SECTION XIV SHIFT MODULATOR SYSTEM


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# SHIFT MODULATOR SYSTEM



## GENERAL INFORMATION

### DESCRIPTION

Change of direction while the tractor is in motion is an undesirable operating technique. The shift modulator system was designed to protect the tractor from damage resulting from directional shifting while the tractor is in motion.

### PREVENTIVE MAINTENANCE

Cleanliness, a clean tight ground and corrosion free connections are the most important maintenance requirements.

### REQUIRED TOOLS

Standard Mechanics Hand Tool Set.

Torque Wrench - 0-50 in. -lbs. rating.

A 12 foot length of 16 gauge electrical wire (to be used as a jumper wire) and several shorter wires.

## PRINCIPLES OF OPERATION

### GENERAL

A magnetic pickup is attached to the transmission. Rotation of the transmission gear (in proximity to the magnetic pickup) causes an A. C. signal to be generated. This A. C. signal is conducted to a control "wafer" mounted on a crossmember of the rear main frame. The "wafer" control consists of the electronic components of the modulator system in an encapsulated form. Components of the "wafer" are not separately serviceable. The "wafer" controls an air solenoid valve.

When the tractor is in motion and is shifted to a reverse direction, the air solenoid valve is actuated and automatically applies the brakes and disconnects the transmission through the transmission "Neutral Knockdown Valve."

When the tractor speed has been reduced to the point where the magnetic pickup no longer generates a signal strong enough to energize the control wafer, the air solenoid valve is de-actuated. This releases the brakes and engages the transmission, which allows the tractor to now move in reverse of its original direction. The optimum tractor speed at which the shift modulator system becomes effective has been factory pre-set and should not require further adjustment.

The magnetic pickup is threaded into a bushing in the side of the transmission case. The bushing has two lock-screws which are used to firmly lock the pickup in place. In the event that an adjustment is required to bring the shift modulator into operation at a lower or higher tractor speed, it can be accomplished by loosening the lock-screws in the bushing and either threading the pickup in, toward the transmission gear, to increase the sensitivity of the system, or turning the pickup out, away from the transmission gear, to decrease the sensitivity.

Increasing the sensitivity causes the system to become operative at a slower tractor speed. Decreasing the sensitivity causes the system to become operative at a higher tractor speed.

### ELECTRICAL SENSING SYSTEM

The function of the electrical sensing system is to register vehicle speed and direction and thereby to energize the air solenoid valve (part of the air control system which allows air pressure to activate the neutral knockdown valve and service brakes) when a high-speed directional shift occurs.

The sensing system consists of (1) a control assembly (2) a magnetic sensor which is placed near a transmission gear having a rotating speed proportional to vehicle ground speed, and (3) pressure sensitive switches in the

(Continued on next page)

# SHIFT MODULATOR SYSTEM

## PRINCIPLES OF OPERATION

### ELECTRICAL SENSING SYSTEM-Continued

directional valve and in the torque converter and air pressure gauge lines. Operation of the sensing system is best understood by observing system changes as the transmission directional lever is moved through its three positions.

Directional lever in "NEUTRAL," engine at low idle:

When the engine is started and idling, pressure builds up in the torque converter and air pressure gauge lines. Pressure build-up in these lines mechanically closes the contacts in the "ON/OFF" switch (torque converter pressure line) and in the "SAFETY" switch (air pressure line). With these contacts closed, current from the battery is allowed to flow through the switches to the "wafer" and the switching transistor within it. The switching transistor, however, will not be activated by the small flow of current with the engine at low idle.

NOTE: System air pressure must be at least 60 psi before the "SAFETY" switch will close. If the vehicle air system should fail and the service brakes cannot be used to stop the vehicle, the switch will open and shut off current flow to the "wafer" (thus making the shift modulator inoperative). With the modulator inoperative, the vehicle can be stopped by directional shifting the transmission.

Directional lever in "FORWARD," vehicle beginning to move forward:

When the directional lever is moved to "FORWARD," oil pressure in the directional valve mechanically closes the contact in the forward clutch pressure switch. As the vehicle begins to move forward, the spinning transmission gear and the magnetic sensor serve as an alternator to create a small A. C. signal. This signal is transmitted through the sensor and "wafer" and is converted to direct current. (Fig. 14-1.)

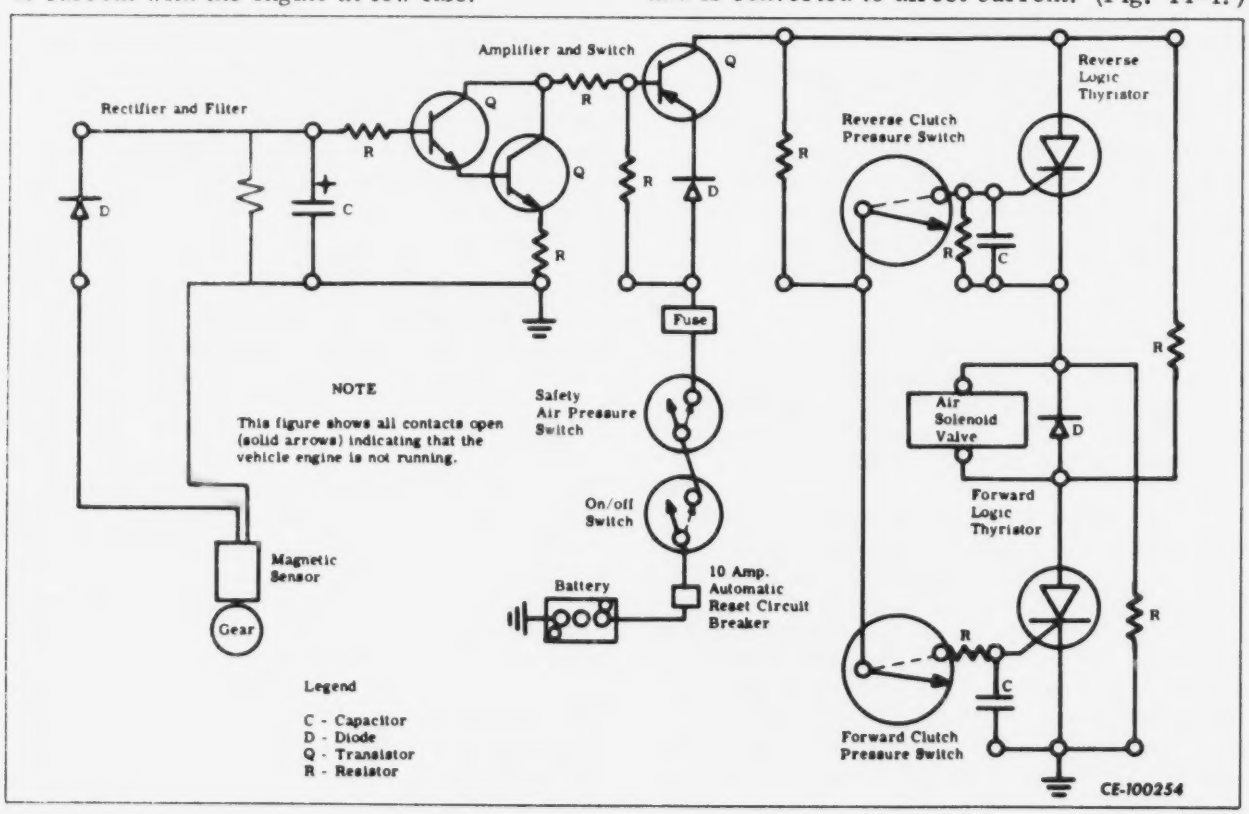


Figure 14-1
Electrical Sensing System.

## PRINCIPLES OF OPERATION

This D. C. current flows through the D. C. amplifier to the switching transistor. When the switching transistor is energized, the battery current is allowed to flow to the forward logic thyristor. Because the forward clutch switch contact has already been closed by oil pressure in the directional valve, current is allowed to flow through the forward logic thyristor. It is now possible to remove the current from the forward clutch switch by moving the directional lever to "NEUTRAL" and yet keep the forward logic thyristor energized by the holding resistor. The directional lever can thus be moved at will between "FORWARD" and "NEUTRAL" without activating the shift modulator.

Directional lever moved to "REVERSE," vehicle traveling forward above 1/4 mph:

As the directional lever is moved to "REVERSE" (vehicle traveling forward at a speed of 1/4 mph or above) the oil pressure in the directional valve mechanically closes the contact in the reverse clutch pressure switch while a pressure drop at the forward clutch pressure switch causes its contact to open. Current is now allowed to flow from the switching transistor through the reverse logic thyristor, the air solenoid valve and forward logic thyristor to ground.

Completion of this circuit activates the air solenoid valve. The air solenoid valve allows regulated air pressure to activate the service brakes and transmission to disconnect valve until the signal from the magnetic sensor is no longer strong enough to energize the switching transistor. At this speed, the switching transistor opens and cuts off current flow to the modulator sensing system. The air solenoid valve then deactivates, releasing brakes and allowing the transmission to engage. Conversely, the air solenoid valve will be energized when a high speed directional shift occurs from reverse to forward - the only difference being the order in which the sensing system components are energized.

## AIR CONTROL SYSTEM

The modulator air system (refer to Fig. 14-2) consists of (1) a pressure regulator which receives system air pressure from a bottom port on the right treadle valve and reduces the system pressure from 105 to 70 psi, (2) an air solenoid valve which controls air flow from the pressure regulator, and (3) a double check valve which channels air flow to the double check valve on the right treadle (for brake application) and to the neutral knockdown valve (for transmission disconnect). A third air line between the double check valve and a top port on the left treadle allows (upon full application of either left or right treadle) full system air pressure (105 psi) to override the modulator application (70 psi) of the brakes and neutral knockdown valve.

Pressure regulator check and adjustment. (Refer to Fig. 14-2). The pressure regulator has an air pressure gauge in the body of the regulator. The gauge should not read over 70 psi. If the pressure indicated is below 70 psi, loosen the lock nut and turn the adjusting screw clockwise to raise the pressure. If the pressure is above 70 psi, apply a brake treadle several times till the air pressure is below 70 psi. Then back off the adjusting screw until compression is released from pressure spring. Re-adjust pressure by turning adjusting screw clockwise until the 70 psi pressure is reached. Tighten the lock nut.

(Continued on next page)

# SHIFT MODULATOR SYSTEM

## PRINCIPLES OF OPERATION

### AIR CONTROL SYSTEM - Continued

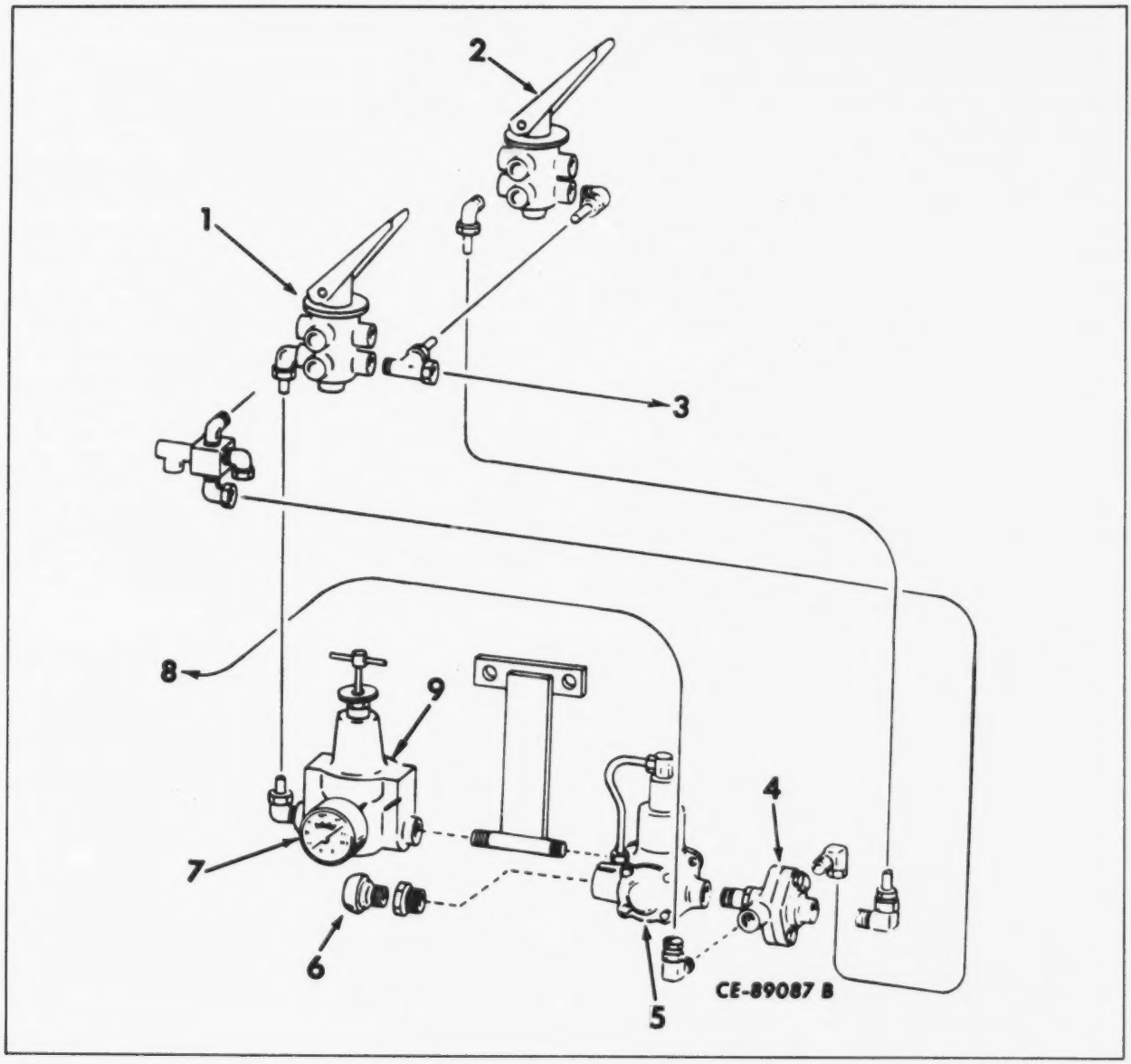


Figure 14-2
Air Control System.

1. R. H. Treadle valve.
2. L. H. Treadle valve.
3. To front reservoir.
4. Double check valve.
5. Air solenoid valve.
6. Breather.
7. Pressure gauge.
8. To transmission "Neutral Knockdown Valve."
9. Pressure regulator.

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## PRINCIPLES OF OPERATION

### PRESSURE REGULATOR

The pressure regulator limits the pressure of the air flowing to the air solenoid valve from the reservoir.

Air pressure flows through a cartridge assembly and is also applied against the lower side of the diaphragm, opposing the thrust of the control spring, holding the cartridge open. When the air pressure against the diaphragm exceeds the valve setting, the control spring is overcome and the diaphragm is raised, allowing the compensating spring to close the cartridge. When the pressure drops, the control spring forces the cartridge open and pressure again passes through the valve. The regulated pressure is adjusted by the adjusting screw, changing the amount of compression maintained on the control spring.

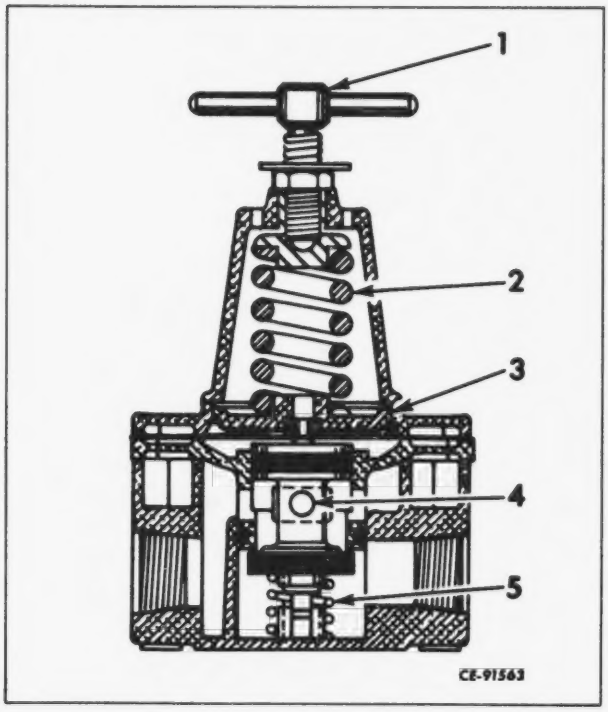


Figure 14-3
Cutaway of Pressure Regulator.

1. Adjusting screw.
2. Control spring.
3. Diaphragm.
4. Cartridge.
5. Compensating spring.

### AIR SOLENOID VALVE

Air from the pressure regulator enters the valve (1) and into the cavity in back of the spindle assembly where it is sealed off. Flow also enters the pilot passageway (2) to the diaphragm where it is sealed off by the plunger (3). (Fig. 14-4.)

(Continued on next page)

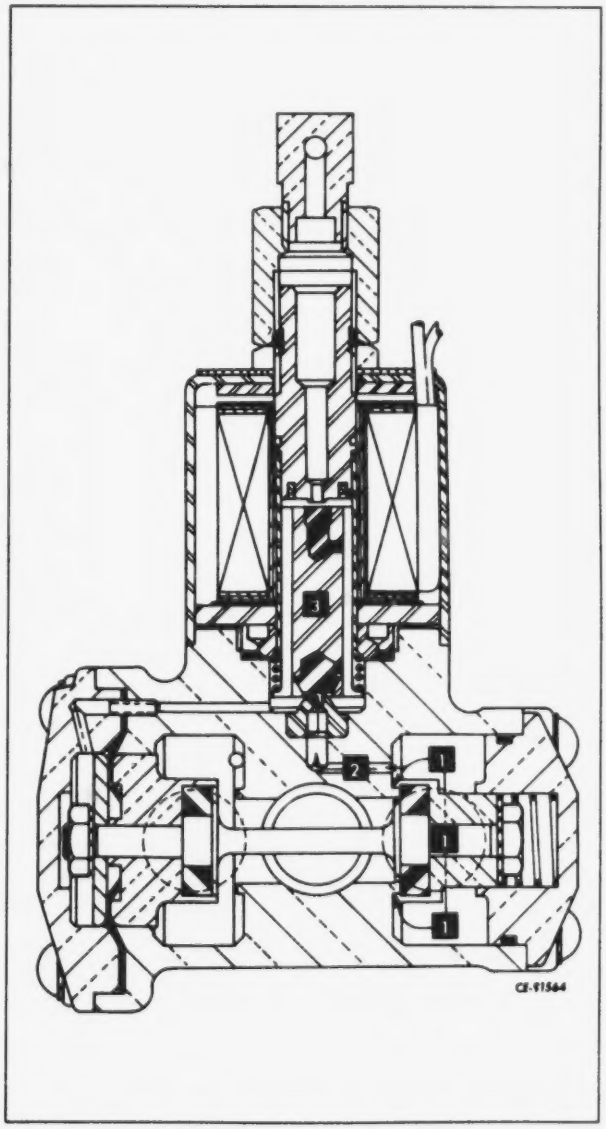


Figure 14-4
Cutaway of Air Solenoid Valve (Closed).

## PRINCIPLES OF OPERATION

### AIR CONTROL SYSTEM - Continued

#### AIR SOLENOID VALVE - Continued

When the coil (4, Fig. 14-5) is energized, the plunger moves upward against the stop. The upward movement allows the air flow from passageway (2) into the passageway (5) to the diaphragm. The air pressure in the diaphragm cavity overcomes the spring force on the opposite end of the spindle. The spindle movement allows the flow (1) into the spindle cavity and through the outlet port (6) to the transmission and brakes.

When the coil (4, Fig. 14-6) is de-energized, the plunger (3) is returned to its seat by the plunger spring. This movement seals off the air flow from the passageway (2) and opens the exhaust passageway (7). The force of the spring on the spindle end overcomes the air pressure in the diaphragm cavity causing the air to flow through the passageway (5), around the plunger (3), through the exhaust passageway (7) and out the exhaust port (8).

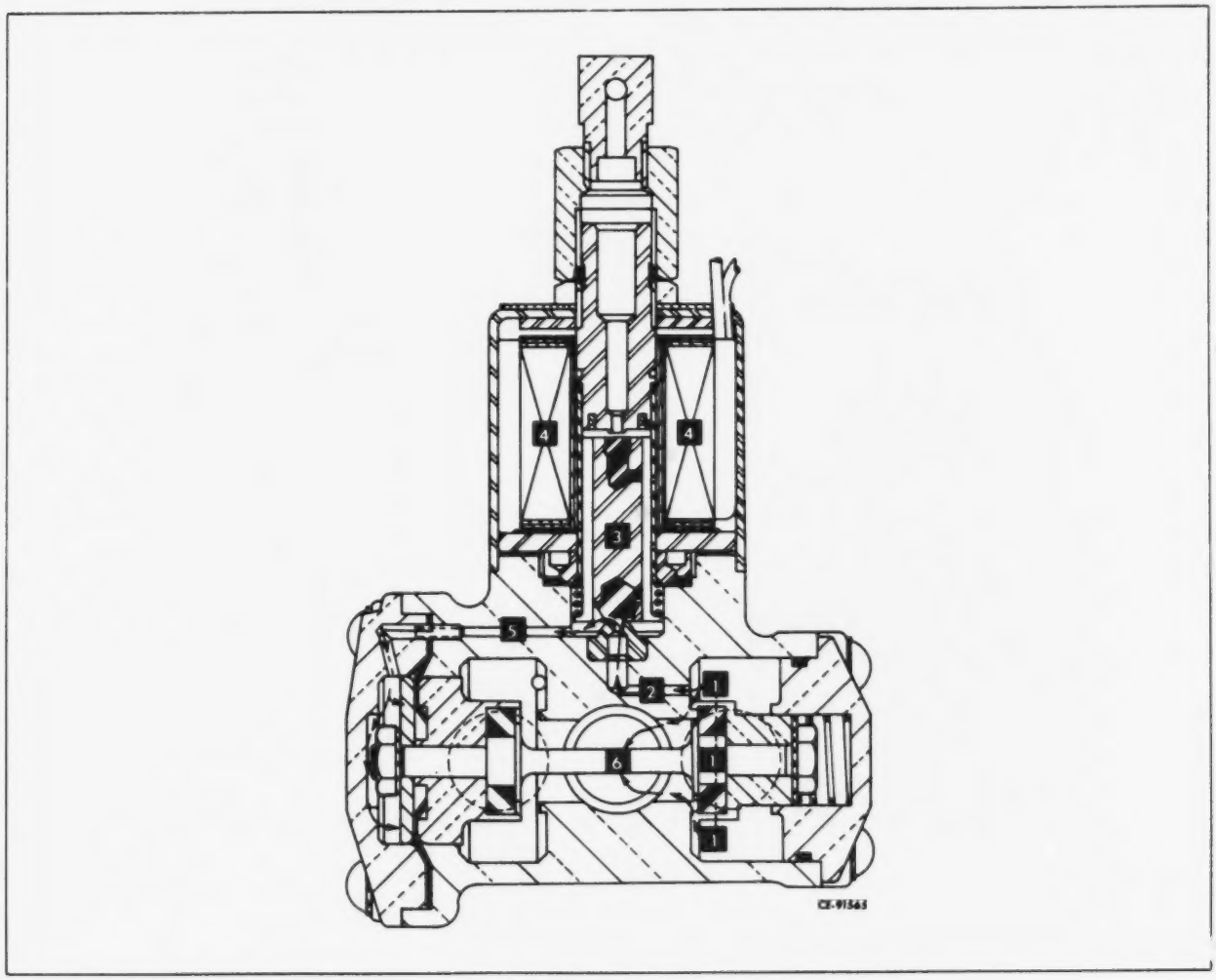


Figure 14-5
Cutaway of Air Solenoid Valve (Open).

## PRINCIPLES OF OPERATION

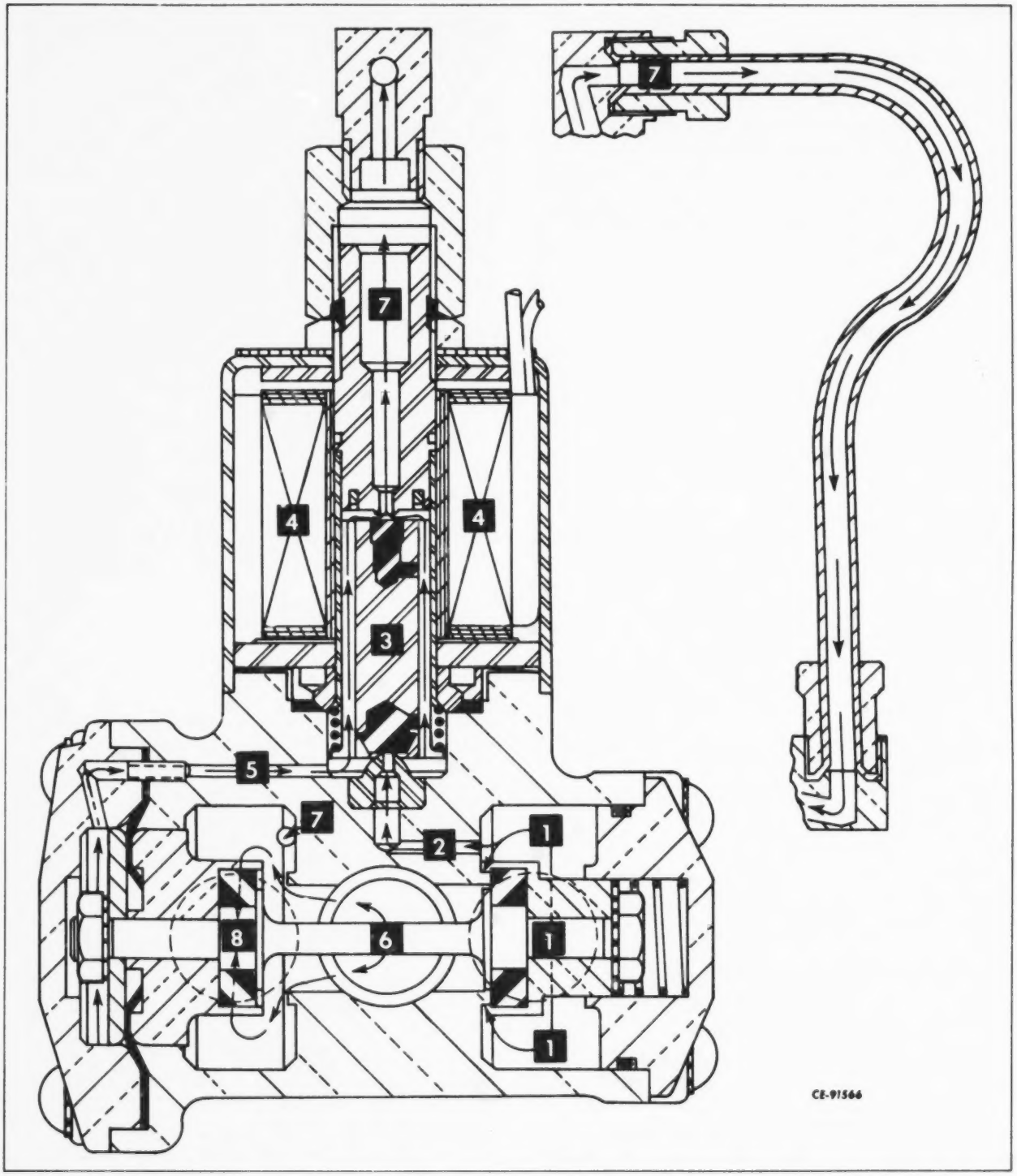


Figure 14-6
Cutaway of Air Solenoid Valve (Closed).

# SHIFT MODULATOR SYSTEM

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### GENERAL

The shift modulator air control system components are attached to a bracket (2, Fig. 14-7) mounted on the inner wall on the left side of the front frame. To gain access to these components, remove the access panel from the outside of the frame wall. Removal of the bracket and its attached components as a unit rather than removing each component individually is suggested for ease in servicing.

### REMOVAL

Exhaust all air from system and reservoirs. Tag and disconnect all lines and electrical connections. Remove hardware securing bracket and remove bracket and components to a clean work bench.

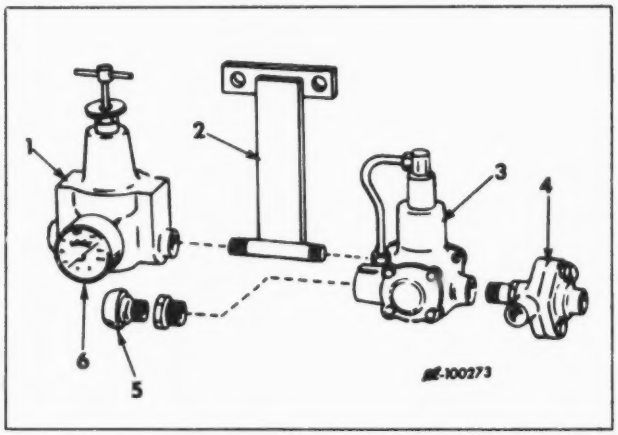


Figure 14-7

1. Pressure regulator.
2. Mounting bracket.
3. Air solenoid valve.
4. Double check valve.
5. Breather.
6. Pressure gauge.

### PRESSURE REGULATOR

#### DISASSEMBLY

Remove pressure gauge (6, Fig. 14-7) from pressure regulator (1).

Loosen lock nut (3, Fig. 14-8) and unscrew adjusting screw (1). Remove screws (4). Separate bonnet (5), spring seat (6), spring (7) and diaphragm (8). Remove cartridge assembly from body (11). Remove nut (15) and poppet (16).

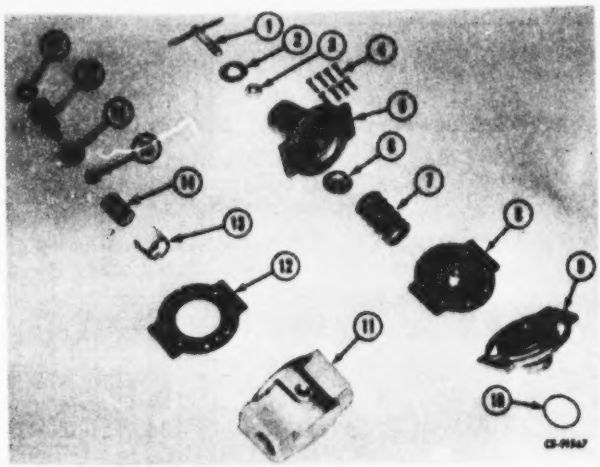

Figure 14-8

Slide piston (17) out of cartridge (9). Remove piston seal (18) from piston. Remove "O" ring (10). Remove compensating spring (14), gauge port shield (13) and gasket (12) from body.

#### INSPECTION

Clean and inspect valve as follows:

Clean all metal parts in a good grade cleaning solvent. Use compressed air to dry parts.

Replace diaphragm, "O" ring, gasket, poppet and piston seal with a service kit.

If any other part shows wear or damage, replace complete regulator assembly.

#### ASSEMBLY

Install shield (13, Fig. 14-8) and spring (14) in body (11) and gasket (12) on body. Install seal (18) on piston (17). Slide piston in cartridge (9) and install poppet (16) on it. Secure with nut (15). Install "O" ring (10) on cartridge; slip cartridge assembly in body. Position diaphragm (8), spring (7), seat (6) and bonnet (5) over body assembly and align holes. Install and tighten screws (4). Thread plate (2) and lock nut (3) on adjusting screw (1). Thread adjusting screw into bonnet until it engages spring seat.



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## DISASSEMBLY, INSPECTION AND ASSEMBLY

### AIR SOLENOID VALVE

#### DISASSEMBLY

Remove breather (5, Fig. 14-7).

Unscrew nuts (2, Fig. 14-9) and remove tube (3). Remove elbows (1).

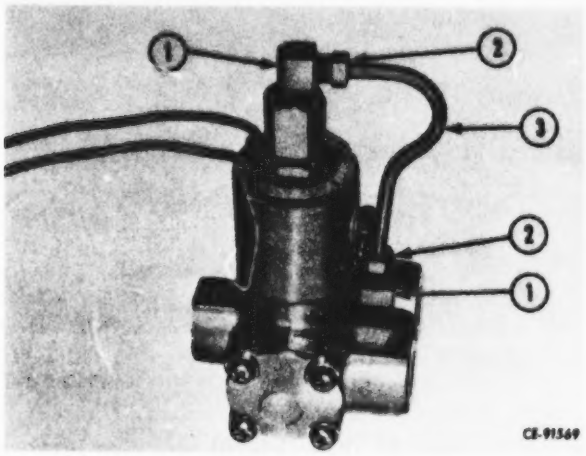


Figure 14-9

Remove adapter (1, Fig. 14-10), seal (2) and nut (3).

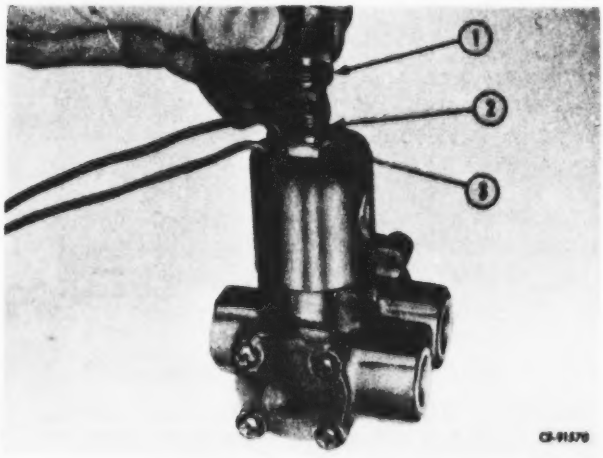


Figure 14-10

Remove housing (1, Fig. 14-11) and coil (2).

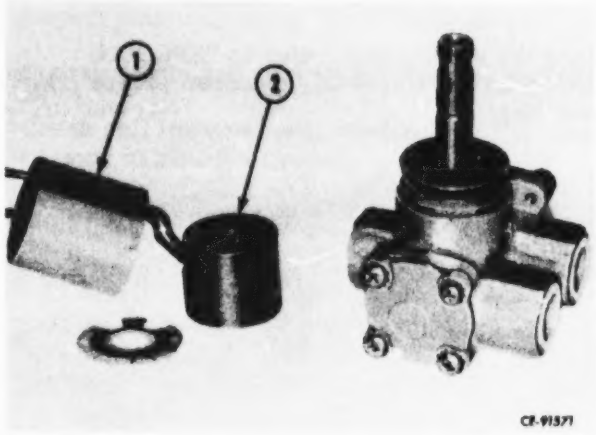


Figure 14-11

Slide flux plate (1, Fig. 14-12) and spring washer (3) from sleeve (2).

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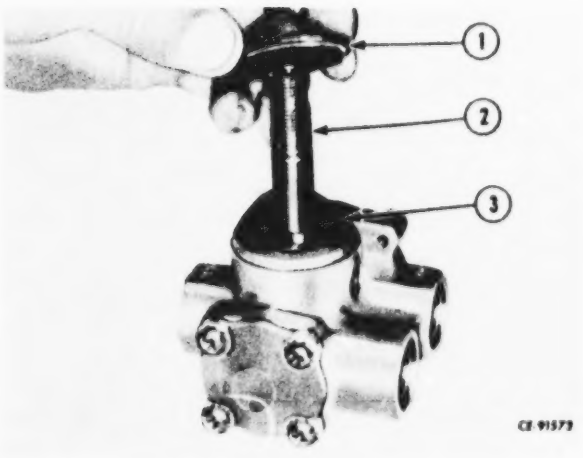


Figure 14-12

# SHIFT MODULATOR SYSTEM

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### AIR SOLENOID VALVE - Continued

DISASSEMBLY - Continued

Using the special tool (refer to "SPECIAL TOOLS") (2, Fig. 14-13), unscrew sleeve (1) from body (3).

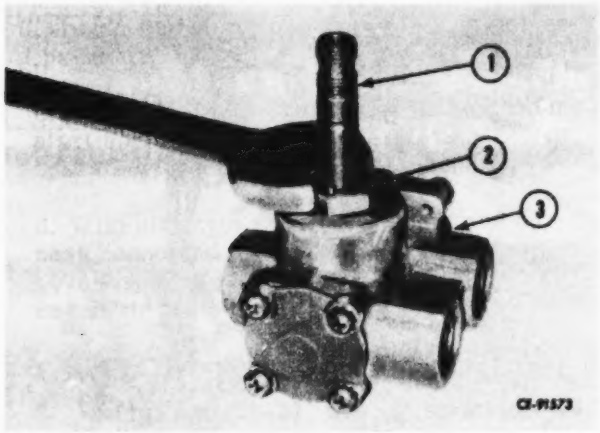


Figure 14-13

Remove flange seal (3, Fig. 14-14), plunger spring (1) and plunger (2) from body (4).

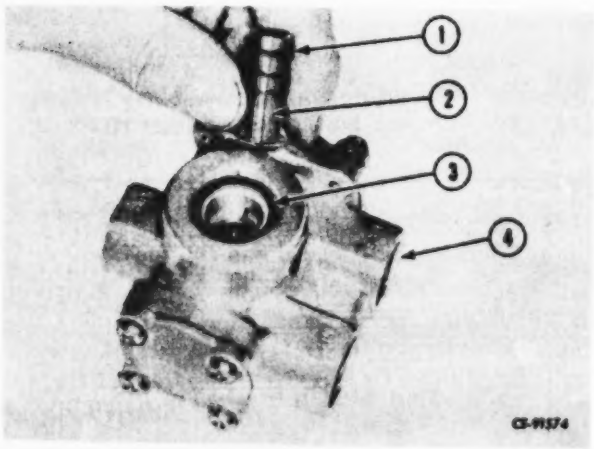


Figure 14-14

Remove screws (4, Fig. 14-15) securing small cover (1). Remove cover and spring (3). Remove "O" ring (2) from cover.

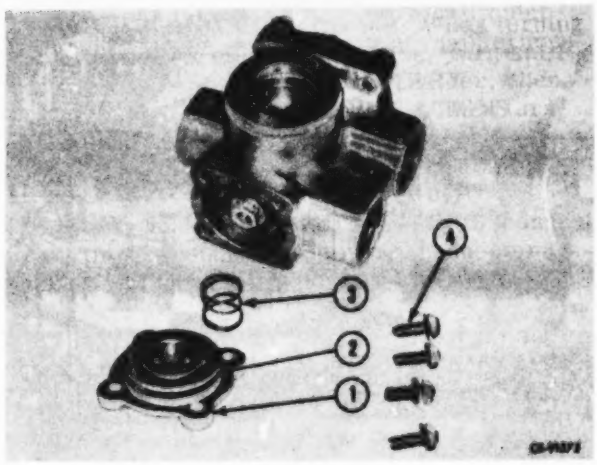


Figure 14-15

Remove screws (1, Fig. 14-16) securing large cover (2). Remove cover.

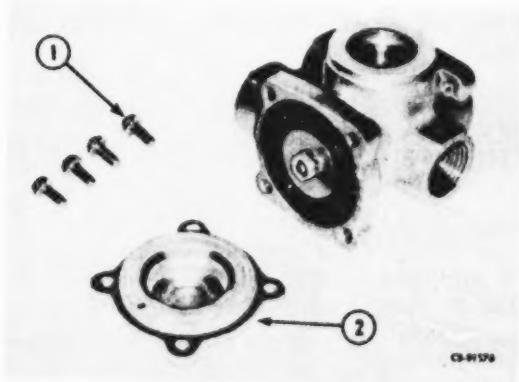


Figure 14-16

Hold nut (1, Fig. 14-17) on diaphragm end of spindle and remove nut (4) from other end. Remove seal retainer (3) and seal (2) from spindle. Slide spindle and diaphragm from body.

## DISASSEMBLY, INSPECTION AND ASSEMBLY

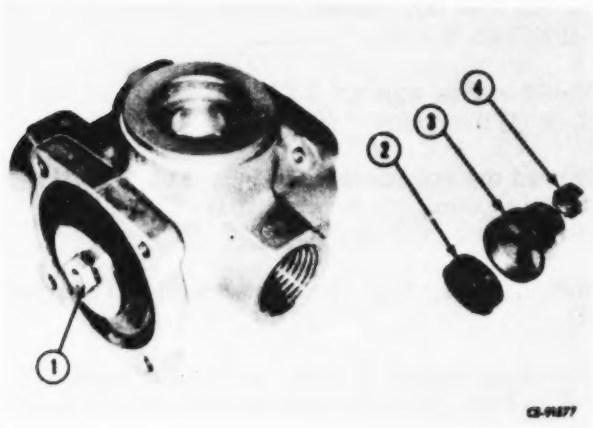


Figure 14-17

Remove nut (1, Fig. 14-18) while holding spindle (6). Slide diaphragm retainer (2), diaphragm (3), seal retainer (4) and seal (5) from spindle.

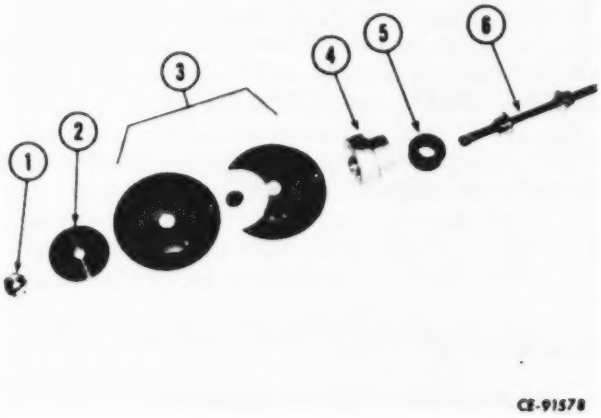


Figure 14-18

### INSPECTION

Clean and inspect air solenoid valve as follows:

Clean all metal parts in a good cleaning solvent.

Clean plunger assembly, diaphragm seals and "O" ring in kerosene.

Use filtered compressed air to dry parts.

Inspect seals, "O" ring and plunger ends for excessive wear or damage.

Inspect diaphragms for tears or abrasion.

Check spindle and springs for wear or damage.

Check coil for continuity. Replace coil if it has an open or shorted circuit.

Replace any parts found to be damaged.

### ASSEMBLY

Slide seal (5, Fig. 14-18) and seal retainer (4) on longer end of spindle (6).

NOTE: The diaphragm assembly (3) is composed of three parts. They are: a diaphragm with a locating tube hole, a diaphragm with a locating tube hole and a bleed hole and a diaphragm spacer.

Install diaphragm assembly on spindle as follows:

Place diaphragm with bleed hole, diaphragm spacer and remaining diaphragm, in that order, on spindle.

Align locating tube holes in diaphragms. Press center of diaphragm assembly over shoulder diameter of seal retainer. The inner diaphragm area should be pushed downward into undercut of retainer. This insures metal-to-metal contact between diaphragm retainer and seal retainer shoulder.

While maintaining alignment, install retainer (2) (rounded edge to diaphragm) and secure with spindle nut (1). Tighten nut to recommended torque. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

Slide spindle assembly into bore of body with locating hole in diaphragm over locating tube in body. Hold nut (1, Fig. 14-17) on diaphragm end and install seal (2), seal retainer (3) and

(Continued on next page)

## DISASSEMBLY, INSPECTION AND ASSEMBLY

### AIR SOLENOID VALVE - Continued

#### ASSEMBLY - Continued

nut (4). Tighten nut to recommended torque. Refer to "SPECIAL TORQUES" in this section.

Torque: _____

While holding spindle from small cover end to keep diaphragms smooth, install large cover (2, Fig. 14-16). Install and tighten cover retaining screw (1). Refer to "SPECIAL TORQUES" in this section.

Torque: _____

Install new "O" ring (2, Fig. 14-15) in groove of cover (1). Hold one end of spring (3) against seal retainer and position cover over other end. Install cover and secure with retaining screws (4). Refer to "SPECIAL TORQUES" in this section.

Torque: _____

Position flange seal (3, Fig. 14-14), plunger (2) and plunger spring (1) in body (4).

Slide sleeve (1, Fig. 14-13) over plunger and thread it into body (3) hand tight. Using the special tool (2), tighten sleeve. (Refer to "SPECIAL TOOLS.")

Install spring washer (3, Fig. 14-12) and flux plate (1) over sleeve (2).

Thread the two leads of coil (2, Fig. 14-11) through grommets in housing (1). Install coil and housing over sleeve.

Install nut (3, Fig. 14-10), seal (2) and adapter (1).

Install one elbow (1, Fig. 14-9) in adapter and one in body. Connect each end of tube (3) to an elbow. Tighten nuts (2).

Thread breather (5, Fig. 14-7) into valve and tighten securely. The double check valve (3), breather (5) and gauge (6) are not serviceable items. If defective, they must be replaced in their entirety.

#### INSTALLATION

Thread pressure regulator and solenoid valve onto mounting bracket. Assemble double check valve to solenoid valve. Secure mounting bracket with assembled units to sidewall of frame with proper hardware and tighten securely.

Connect previously tagged lines and wires, being sure that all connections are tight.

## SERVICE INFORMATION

### TROUBLE SHOOTING

#### SOLENOID VALVE

Test Conditions:

1. Engine off.
2. Air pressure at 30 psi minimum.

a. Disconnect loom plug at control assembly or "wafer." Attach one end of a jumper wire to socket "E," Fig. 14-19 and the other end to a clean tight ground.

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## SERVICE INFORMATION

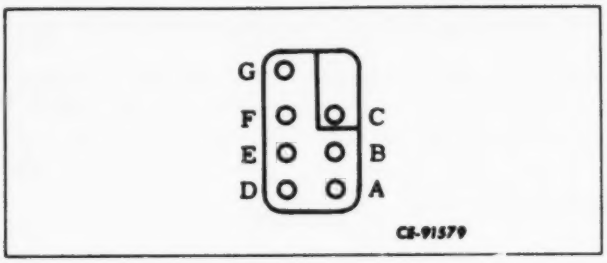


Figure 14-19
Socket End of Loom.

b. Attach one end of the long jumper wire to socket "D," Fig. 14-19 and touch free end to positive side of battery (24V DC).

c. The solenoid valve should apply the brakes when battery is touched. (If brakes have been applied, air will be heard exhausting from solenoid valve breather when jumper wire is removed from battery.)

NOTE: If after removing jumper wire and exhaust air is heard but brakes are not released, check flow regulator to see that nut has not loosened and screw gone out of adjustment.

d. If solenoid valve does not apply brakes, disconnect solenoid wires. Connect a jumper wire to one solenoid wire and the other end to ground. Connect the other solenoid wire to jumper wire from battery. If brakes are applied, replace loom. If brakes are not applied, repair or replace solenoid valve.

### "SAFETY" SWITCH, "ON/OFF" SWITCH AND FUSE

Test Conditions:

1. Vehicle frames locked in full left turn with safety bar and pins.

2. Air pressure at 70 psi minimum.

3. Loom plug disconnected, jumper wire from socket "E" (Fig. 14-19) to ground.

4. Engine running at low idle.

a. Connect a jumper wire between sockets "G" and "D." If solenoid valve applies brakes, "safety," "on/off" switches and fuse are functioning. Disconnect jumper wire.

b. If brakes are not applied, remove instrument panel.

NOTE: Disconnect battery ground cable during panel removal.

c. Connect one end of long jumper wire to socket "D" and touch other end to each terminal on "safety" switch (terminals A and B, Fig. 14-20). Brakes should be applied as each switch terminal is touched. If brakes are applied on just one terminal, switch is malfunctioning and should be replaced.

d. Test fuse by touching one of its ends to positive side of battery and other end to jumper wire connected to socket "D." If brakes are not applied, replace fuse.

e. Connect one end of long jumper wire to socket "D" and touch other end to each terminal on "on/off" switch (terminals C and D, Fig. 14-20) located on transmission case. Brakes should be applied as each switch terminal is touched. If brakes are applied on just one terminal, switch is malfunctioning and should be replaced.

(Continued on next page)

# SHIFT MODULATOR SYSTEM

## SERVICE INFORMATION

### TROUBLE SHOOTING - Continued

"SAFETY" SWITCH, "ON/OFF" SWITCH AND FUSE - Continued

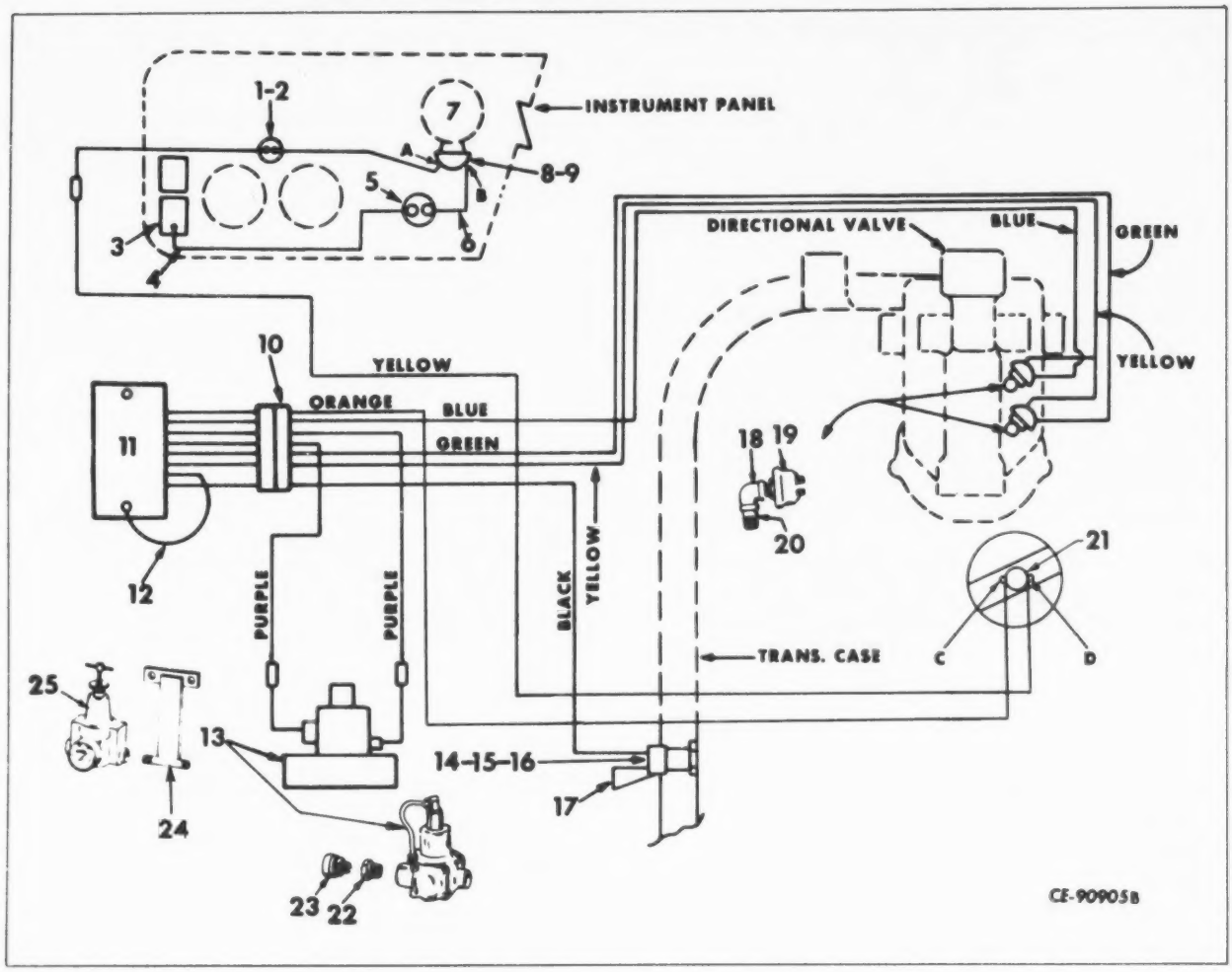


Figure 14-20
Modulator Wiring.

1. Fuse holder.
2. Fuse.
3. Circuit breaker.
4. Circuit breaker-to-ignition switch wire.
5. Ignition switch.
6. Ignition switch-to-pressure switch wire.
7. Air pressure gauge.
8. Pressure switch ("safety switch").
9. Tee.
10. Wiring harness.
11. Control unit.
12. Ground wire.
13. Solenoid valve.
14. Set screw.
15. Magnetic pickup.
16. Pickup adapter.
17. Ground-to-cable clamp wire.
18. Elbow.
19. Pressure switch.
20. Nipple.
21. Pressure switch ("on-off" switch).
22. Reducer bushing.
23. Breather.
24. Support.
25. Pressure regulator.

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## SERVICE INFORMATION

### DIRECTIONAL VALVE PRESSURE SWITCHES

Test Conditions:

1. Vehicle frames locked in a turn with attaching pins.

2. Engine running at low idle.

3. Air pressure at 70 psi minimum.

4. Loom plug disconnected, jumper wire from socket "E," Fig. 14-19 to ground.

5. Blue wire must be attached to "FORWARD" (upper) directional valve switch Fig. 14-20) and green wire to "REVERSE" (lower) switch.

   a. Place blocks in front and back of each wheel and lower bucket to ground to prevent vehicle movement. Place transmission range lever in second gear.

   b. Connect a jumper wire between sockets "G" and "B" and a jumper between sockets "C" and "D." Shift directional lever from "N" to "FORWARD" to "N." If brakes are not applied, replace "FORWARD" directional valve switch.

   c. Connect a jumper wire between sockets "G" and "B" and a jumper between sockets "F" and "D." Shift directional lever from "N" to "REVERSE" to "N." If brakes are not applied, replace "REVERSE" directional valve switch.

### SPEED SENDING CIRCUIT

Test Conditions:

1. Vehicle frames locked in full left turn with safety bar and pins.

2. Loom socket and control assembly plug connected.

   a. Remove all wires from pressure switches in directional valve (refer to Fig. 14-20) and attach wires together with a suitable nut and bolt. (Do not allow wires to touch frame.)

   b. Remove magnetic sensor wire from sensor and sensor from transmission. Reconnect wire to sensor and place magnetic pole end of sensor against transmission case or vehicle frame.

   c. Start engine and allow it to run at low idle. Air pressure must be at 70 psi minimum.

   d. Pull sensor away quickly from case or frame. If brakes are not applied and then released, replace following parts in given order, retesting after each new component is installed.

> NOTE: In some units, brakes will apply only if sensor is moved toward transmission case or frame.

Replacement parts:

(a) Magnetic sensor.
(b) Control "wafer."
(c) Wire loom.

> NOTE: After testing is completed, be certain that all wire connections are secure, and that magnetic sensor adjustment is correct and firmly locked in place.

# SHIFT MODULATOR SYSTEM

## SERVICE INFORMATION

### ADJUSTMENT

The shift modulator system is in correct adjustment when a smooth reversal of direction is accomplished at a tractor speed above 5 mph. The stop lights will light during vehicle deceleration and go out just before the vehicle changes direction. Also, an audible air discharge will be heard just prior to the directional change, indicating the brakes have released.

If, on moving the directional lever to a position opposite that of tractor motion, a hard, uncomfortable and jerky stop and reversal is experienced, the magnetic sensor on the transmission must be turned clockwise to increase system sensitivity and cause the brakes to be applied sooner.

If, on moving the directional lever to a position opposite that of tractor motion, the tractor stops and pauses perceptibly before the brakes release and the audible air discharge is heard, the magnetic sensor must be turned counterclockwise to decrease system sensitivity and allow the brakes to release sooner.

To adjust the magnetic sensor, loosen both lock-screws in the sensor bushing. Be sure to securely tighten both lock-screws when satisfactory adjustment is attained.

### SPECIAL TOOLS

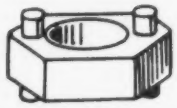


Figure 14-21
Air Solenoid Valve Special Nut Tool. Hough Part #884368C1.

### SPECIFICATIONS

| | |
|---|---|
| PRESSURE REGULATOR | |
| Make | Parker-Hannifin |
| Model | R-2050 |
| Pressure Setting | 70 psi |
| SOLENOID VALVE | |
| Make | Skinner Electric Valve Div. |
| Model | LP3LA4150 |
| Type | Three-way |

### SPECIAL TORQUES

| | |
|---|---|
| Air solenoid valve cover retaining screws | 18 inch-lbs. |
| Air solenoid valve spindle nuts | 18 inch-lbs. |

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## SERVICE BULLETIN REFERENCE

| NUMBER | DATE | SUBJECT | CHANGES |
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# SECTION INDEX

This manual is divided into major sections covering various components of the 817 SERIES C Diesel Engine.

These sections are also indexed by title with thumb index tabs as shown below and to the right.

To use this manual, grasp the right-hand side of book between thumb and fingers. Bend book back and find the pages containing the corresponding section index tab.

Section identification is also contained in the upper corner of each page.


SECTION 1 — GENERAL

SECTION 2 — MANIFOLD, CYLINDER HEADS AND VALVES

SECTION 3 — CONNECTING RODS, PISTONS, RINGS AND SLEEVES

SECTION 4 — CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL

SECTION 5 — TIMING GEAR TRAIN, FRONT COVER AND CAMSHAFT

SECTION 6 — FAN DRIVE HOUSING AND THERMOSTATS

SECTION 7 — LUBRICATING OIL AND WATER PUMP, OIL FILTERS AND OIL COOLERS

SECTION 8 — TURBOCHARGER

SECTION 9 — INJECTION PUMP, ADAPTER AND INJECTION NOZZLES

SECTION 10 — AIR COMPRESSOR

SECTION 11 — STORAGE BATTERIES

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# INTRODUCTION

## GENERAL

The instructions contained in this service manual are for the information and guidance of servicemen who are responsible for overhauling and repairing International 817 SERIES C diesel engines.

This manual provides the servicemen with a fast, convenient reference to information on operation, maintenance and repairs, as well as descriptions of the major units and their functions in relation to other components of the engine.

## LUBRICATION

Instructions on the lubrication of each assembly are given in the "LUBRICATION GUIDE" in the Operator's Manual. When assembling any parts, always coat all wearing surfaces with the lubricant specified in the guide. Use sufficient quantities of lubricant to prevent any danger of seizing, scoring or excessive wear when the assembly is first operated. Failure to provide "starting lubricaton" may result in serious damage. (Refer to Par. 13, "PRIMING LUBRICATING SYSTEM" in Section 3.)

## GASKETS AND SEALS

Always use new gaskets and seals. When installing a seal, be sure to install it as specified in the instructions. Be extremely careful not to damage the seal in any way during installation.

## SERVICE TOOLS

International engines are designed so that few service tools are required other than those in the mechanic's tool kit. Wherever the application of inexpensive special service equipment will facilitate work, it is shown. Otherwise, it is assumed that servicemen will select from their tool kits such tools as are required. Information regarding special tool equipment is given in the "Service Tool Manual," ISS-1531. Your distributor has most of this equipment and is in an excellent position to service these engines.

## SERVICE PARTS

Always use genuine IH service parts. The best material obtainable, and experience gathered through many years of power equipment manufacturing, enable International Harvester to produce quality that will not be found in imitation or "just as good" repair parts. No serviceman can afford to guarantee a repair job that is not serviced with genuine IH parts. No owner should be satisfied with other than genuine IH parts.

For the correct service parts to be used on a machine, always refer to the parts catalog for the particular machine. The loose-leaf parts catalogs are accurate and are continually being brought up-to-date by the issuance of new pages covering any changes in part numbers.

## SERIAL NUMBERS

The engine serial number is stamped on a pad located on the right side of the engine crankcase below the rear exhaust manifold.

## ENGINE APPLICATION CHART

| Series | Machines Used On |
|---|---|
| 817C | 330 and 340 Pay haulers |
| | TD-25 Series C Crawler Tractor |
| | 560 Pay loader |
| | H-100 C Pay loader |
| | D-120 C Pay loader |
| | UDT and UDTI-817 Series C Power Units |

## ENGINE SERVICE CHART

Refer to Engine Service Charts Manual Form ISS-1516 for Engine Service Chart.

## 1. DESCRIPTION

The 817 SERIES C diesel engine is a heavy-duty high-speed direct starting, four cycle valve-in-head type using a 24-volt starting system and direct fuel injection.

The crankshaft is fully counterbalanced. It is supported by seven steel-backed trimetal type main bearings with the rear bearing, No. 7, absorbing the crankshaft end thrust. The connecting rod bearings are also of the steel-backed trimetal type.

The camshaft is supported by seven bearings with the thrust being taken on the front bearing. The bearings are steel shells, solid or split, with babbitt bearing material. The camshaft has two lobes per cylinder, one each for exhaust and intake valves. It is driven directly from the crankshaft gear.

The aluminum-alloy, tin-plated, solid-skirt pistons are cam ground, and are fitted with two compression and one oil control ring. The full-floating type piston pins are held in place by snap rings at the ends of each pin. The under surface of the piston crowns are jet-cooled by lube oil.

Forged steel connecting rods contain a bronze bushing at the upper end for installation on the piston pin, while the lower end and cap contain the locking type precision fit bearing inserts.

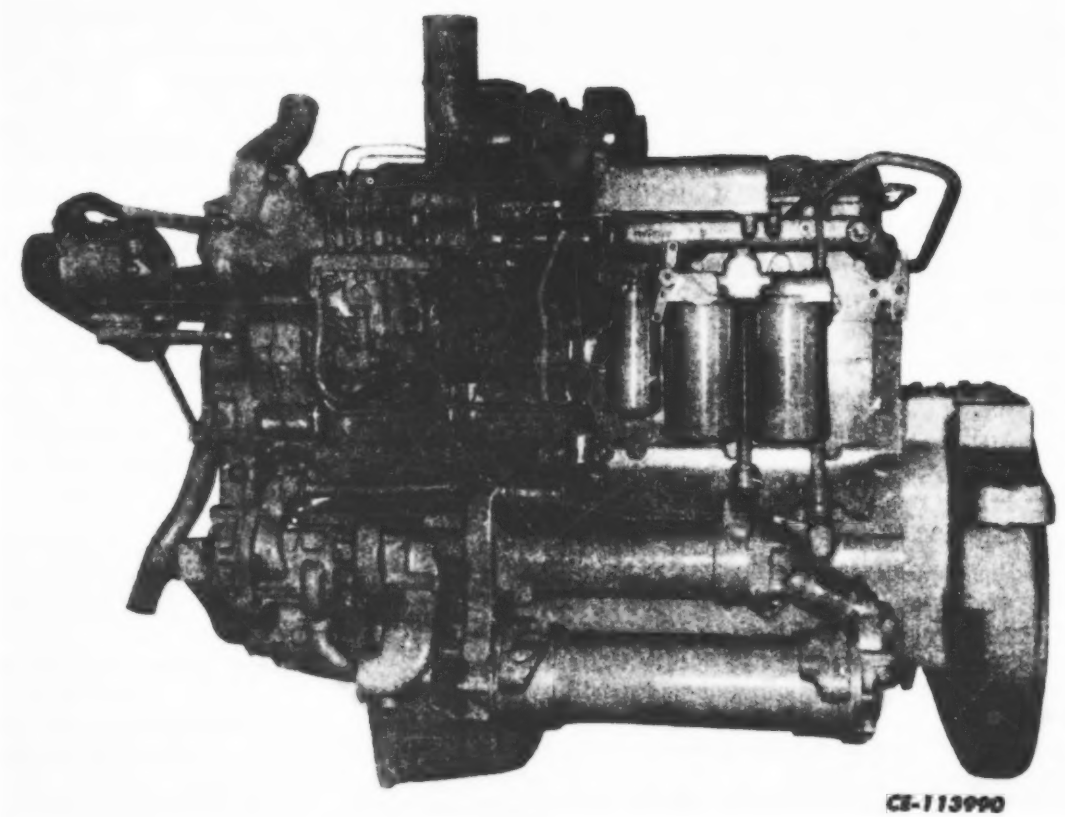



Fig. 1. 817 Series C Diesel Engine (TD-25 Series C Shown).

# GENERAL

There are two cylinder heads, each covering three cylinders. There are two intake and two exhaust valves per cylinder. Each pair is actuated by a rocker arm and guided bridge.

Bridges have an adjustment at one end to insure even contact with both valves. Positive-type rotators are used on all intake and exhaust valves. Replaceable valve seat inserts are used on exhaust and intake valves.

The cylinder sleeves are the replaceable wet type. Three "O" rings, located in grooves at the lower end of the sleeve, provide an effective seal between the cylinder sleeve, crankcase and the water jacket surrounding it.

The full pressure lubrication system assures positive lubrication to all working parts. A gear type oil pump is externally mounted to the left side of the crankcase. Oil is drawn from the oil pan by the pump and is distributed under pressure through rifle-drilled passages in the crankcase and crankshaft.

Piston cooling jets (located on the right side of the crankcase) spray each piston with 5.7 l (1-1/2 gallons) of oil per minute.

Coolant is circulated through the engine and radiator by a centrifugal water pump mounted on a common shaft with the lube oil pump. Two thermostats located in the water outlet header control the coolant temperature in the system.

The fuel system consists of the fuel lines, fuel filters, injection pump, injection nozzles and lines.

## 2. SPECIFICATIONS

| | |
|---|---|
| Number of cylinders | 6 |
| Type of cylinder sleeves | Replaceable, wet |
| Bore and stroke — inches | 137 x 152mm (5-3/8 x 6 in.) |
| Displacement | 13.4 l (817 in.$^3$) |
| Rotation (engine and injection pump) | Counterclockwise (viewed from flywheel end) |
| Firing order | 1-5-3-6-2-4 |
| Compression ratio: | |
| Running | 15.1:1 |
| Injection pump timing — static (crankshaft degrees): | |
| 330 and 340 Pay haulers<br>TD-25 Series C Crawler<br>560 Pay loader<br>H-100C loader<br>D-120C Pay loader<br>UDT and UDTI-817C | 38° BTDC |

### CRANKSHAFT

| | |
|---|---|
| Crank pin, diameter | 88.811-88.837mm (3.4965-3.4975 in.) |
| Main journal diameter | 114.275-114.300mm (4.4990-4.5000 in.) |
| Maximum permissible journal out-of roundness, before reconditioning | 0 .10mm (0.004 in.) |
| Number of main bearings | 7 |
| Main bearing running clearance | 0.066-0.152mm (0.0026-0.0060 in.) |
| Maximum permissible bearing running clearance | 0.218mm (0.0086 in.) |
| End clearance | 0.13-0.28mm (0.005-0.011 in.) |
| Maximum permissible end clearance, before reconditioning | 0.61mm (0.024 in.) |
| Counterbalanced | Yes |
| Main bearing bore in crankcase (line reamed with caps assembled) | 123.04-123.06mm (4.844-4.845 in.) |

### CYLINDER HEADS

| | |
|---|---|
| Overall height | 126.95-127.05mm (4.998-5.002 in.) |
| Minimum allowable reconditioned height | 126.19mm (4.968 in.) |

## CAMSHAFT

| | |
|---|---|
| Running clearance | 0.025-0.140 mm (0.0010-0.0055 in) |
| Maximum permissible running clearance | 0.20 mm (0.008 in) |
| End clearance (*) | 0.18-0.33 mm (0.007-0.013 in) |
| Maximum permissible end clearance | 0.64 mm (0.025 in) |
| Front bearing inside diameter | 76.175-76.264 mm (2.9990-3.0025 in) |
| Intermediate and rear bearing inside diameter | 60.274-60.363 mm (2.3730-2.3765 in) |
| Cam lobe lift: | |
| Intake | 7.544 mm (0.2970 in) |
| Exhaust | 7.595 mm (0.2990 in) |
| Maximum permissible valve cam lobe wear | 0.13 mm (0.005 in) |
| Number of teeth in drive gear | 80 |
| Number of bearings | 7 |
| Bearing journal diameter: | |
| Front | 76.12-76.15 mm (2.997-2.998 in) |
| Intermediate and rear | 60.22-60.25 mm (2.371-2.372 in) |

* Thrust taken by camshaft hub.

## CONNECTING RODS

| | |
|---|---|
| Side clearance | 0.23-0.38 mm (0.009-0.015 in) |
| Bearing running clearance | 0.114-0.191 mm (0.0045-0.0075 in) |
| Maximum permissible bearing running clearance | 0.229 mm (0.0090 in) |
| Bushing inside diameter: | |
| Bore or hone after assembly | 57.166-57.170 mm (2.2506-2.2508 in) |
| Rod pin bore I.D. prior to bushing installation | 60.312-60.363 mm (2.3745-2.3765 in) |

## FLYWHEEL HOUSING (Installed)

| | |
|---|---|
| SAE bore eccentricity with crankshaft (total indicator reading) max. | 0.20 mm (0.008 in) |
| SAE flange face run-out (total indicator reading) max. | 0.20 mm (0.008 in) |

## PISTONS

| | |
|---|---|
| Length over-all | 172.16 mm (6.778 in) |
| Skirt clearance – measured 90 degrees from pin hole: | |
| Bottom | (0.155-0.206 mm (0.0061-0.0081 in) |
| Number of rings per piston | 3 |
| Width of ring grooves- | |
| Compression | Keystone |
| Oil control | 6.388-6.414 mm (0.2515-0.2525 in) |
| Ring side clearance in grooves: | |
| Oil control (new) | 0.048-0.089 mm (0.0019-0.0035 in) |
| Oil control (max) | 0.114 mm (0.0045 in) |

## PISTON RINGS – Compression

| | |
|---|---|
| Number of rings per piston | 2 |
| Type (face and finish): | |
| Top | Barrel – chrome (Keystone) |
| Intermediate | Tapered – chrome (Keystone) |
| Ring gap: | |
| Top | 0.51-0.76 mm (0.020-0.030 in) |
| Intermediate | 0.46-0.71 mm (0.018-0.028 in) |
| Maximum permissible ring gap, before replacing | 1.78 mm (0.070 in) |

# GENERAL

## PISTON RINGS – Oil Control

| | |
|---|---|
| Number of rings per piston | 1 |
| Type | One-piece slotted-chrome |
| Width | 6.32-6.35 mm (0.249-0.250 in) |
| Ring gap | 0.43-0.81 mm (0.017-0.032 in) |
| Maximum permissible ring gap, before replacing | 1.52 mm (0.060 in) |

## PISTON PINS

| | |
|---|---|
| Diameter | 57.132-57.137 (2.2493-2.2495 in) |
| Length | 111.38-111.63 mm (4.385-4.395 in) |
| Clearance – between end of pin and retainer ring | 0.051-0.076 mm (0.002-0.030 in) |
| Clearance – in rod | 0.028-0.038 mm (0.0011-0.0015 in) |
| Maximum permissible clearance in rod, before replacing | 0.10 mm (0.004 in) |
| Clearance – in piston (loose) | 0.015-0.025 mm (0.0006-0.0010 in) |
| Maximum permissible clearance in piston, before replacing | 0.064 mm (0.0025 in) |

## CYLINDER SLEEVES

| | |
|---|---|
| Diameter – inside | 136.540-136.566 mm (5.3756-5.3766 in) |
| Length | 316.7 mm (12.47 in) |
| Maximum permissible diameter sleeve wear, at top of ring travel, before replacement | 0.20 mm (0.008 in) |
| Top surface of sleeve flange extends above top surface of crankcase | 0.05-0.10 mm (0.002-0.004 in) |

## INTAKE VALVES

| | |
|---|---|
| Stem diameter | 11.049-11.074 mm (0.4350-0.4360 in) |
| Minimum permissible stem diameter | 11.011 mm (0.4335 in) |
| Port diameter | 38 mm (1.5 in) |
| Head diameter | 43.18-43.43 mm (1.700-1.710 in) |
| Stem clearance in guide | 0.038-0.102 mm (0.0015-0.0040 in) |
| Maximum permissible stem clearance in guide before reconditioning | 0.178 mm (0.0070 in) |
| Valve face angle – degrees | 30° -0′ to 29° -45′ |
| Valve seat angle in cylinder head – degrees | 30° -0′ to 30° -15′ |
| Valve head protrusion from cylinder head face (New) | 0.50-0.81 mm (0.020-0.032 in) |
| Minimum allowable protrusion | 0.25 mm (0.010 in) |
| Valve lash setting | 0.50 mm (0.020 in) |
| Valve seat insert bore | 45.16-45.19 mm (1.778-1.779 in) |
| Valve margin (Min.) | 50% of a new valve |

## EXHAUST VALVES

| | |
|---|---|
| Stem diameter | 11.049-11.074 mm (0.4350-0.4360 in) |
| Minimum permissible stem diameter | 11.011 mm (0.4335 in) |
| Port diameter | 38 mm (1.5 in) |
| Valve seat insert bore | 45.161-45.187 mm (1.778-1.779 in) |
| Head diameter | 43.18-43.43 mm (1.700-1.710 in) |
| Stem clearance in guide | 0.038-0.102 mm (0.0015-0.0040 in) |
| Maximum permissible stem clearance in guide before reconditioning | 0.178 mm (0.0070 in) |
| Valve face angle – degrees | 45° -0′ to 45° -15′ |
| Valve seat angle in cylinder head from valve center line – degrees | 45° -0′ to 44° -45′ |
| Valve head protrusion from cylinder head face (New) | 0.50-0.81 mm (0.020-0.032 in) |
| Minimum allowable protrusion | 0.25 mm (0.010 in) |
| Valve lash setting | 0.79 mm (0.031 in) |
| Valve margin (Min.) | 50% of a new valve |

### INTAKE AND EXHAUST VALVE GUIDES

Length . . . . . 87.38 mm (3.440 in)
Inside diameter . . . . . 11.113-11.151 mm (0.4375-0.4390 in)
Maximum permissible inside diameter . . . . . 11.25 mm (0.443 in)
Set height of guide – measured upward from top face of cylinder head . . . . . 28.45 mm (1.120 in)

### INTAKE AND EXHAUST VALVE SPRINGS

Outside diameter . . . . . 32.74 mm (1.289 in)
Free length . . . . . 58.47-60.50 mm (2.302-2.382 in)
Test length . . . . . 34.29 mm (1.350 in)
Test load . . . . . 512-556 N (115-125 lbs)

### VALVE LEVER BRIDGE AND BRIDGE GUIDE

Guide length . . . . . 56.7 mm (2.31 in)
Guide inside diameter . . . . . 12.738-12.764 mm (0.5015-0.5025 in)
Maximum permissible guide inside diameter . . . . . 12.81 mm (0.5045 in)
Bridge stem clearance in guide . . . . . 0.038-0.089 mm (0.0015-0.0035 in)
Maximum permissible valve lever bridge wear at valve lever contact surface . . . . . 0.10 mm (0.004 in)

### VALVE LEVER AND SHAFT

Shaft diameter . . . . . 36.068-36.093 mm (1.4200-1.4210 in)
Running clearance, levers on shaft . . . . . 0.03-0.08 mm (0.001-0.003 in)
Maximum permissible running clearance, levers on shaft . . . . . 0.15 mm (0.006 in)
Lever bushing:
Inside diameter (burnish after assembly) . . . . . 36.119-36.157 mm (1.4220-1.4235 in)

### VALVE TAPPETS

Diameter . . . . . 34.82-34.85 mm (1.371-1.372 in)
Length . . . . . 82.6 mm (3.25 in)
Clearance in crankcase . . . . . 0.064-0.140 mm (0.0025-0.0055 in)

### INJECTION NOZZLES

Injection nozzle tip protrusion below bottom surface of cylinder head . . . . 3.51-4.16 mm (0.138-0.164 in)
Opening pressure . . . . . 24130-24820 kPa (3500-3600 psi)
Readjust when opening pressure drops below . . . . . 22755 kPa (3300 psi)

### INJECTION NOZZLE SLEEVES

Injection nozzle sleeve protrusion (max. above finished surface of cylinder head to below) . . . . . 0.08-0.38 mm (0.030-0.150 in)

### VALVE TIMING

Intake opens – degrees:
Before TDC . . . . . $35^{o}$ -8'
Intake closes – degrees:
After BDC . . . . . $43^{o}$ -42'
Exhaust opens – degrees:
Before BDC . . . . . $61^{o}$
Exhaust closes – degrees:
After TDC . . . . . $37^{o}$ -45'

# GENERAL

## LUBRICATING SYSTEM

| | |
|---|---|
| Type | Forced feed |
| Oil filter — type | Full-flow |
| Number used | 3 for element type, 2 for spin-on type |

## LUBRICATING OIL VALVE LOCATIONS

| | |
|---|---|
| Pressure regulating | Regulating valve body (left side of crankcase below filter) |
| By-pass | Oil filter header |

## LUBRICATING OIL VALVE SPRINGS

| | |
|---|---|
| Pressure regulating: | |
| Free length | 65.15mm (2.565 in.) |
| Test length | 43.41mm (1.711 in.) |
| Test load | 78 N (17.5 lbs) |
| By-pass (element type filters): | |
| Free length | 50.37mm (1.983 in.) |
| Test length | 43.05mm (1.695 in.) |
| Test load | 29 N (6.58 lbs) |
| By-pass (spin-on type filters): | |
| Free length | 52.53mm (2.068 in.) |
| Test length | 31.09mm (1.224 in.) |
| Test load | 31 N (6.92 lbs) |

## PRESSURE REGULATING VALVE

| | |
|---|---|
| Opening pressure | 305-360 kPa (44-52 psi) |
| Minimum pressure @ 1000 rpm | 240 kPa (35 psi) |

## TIMING GEARS

| | |
|---|---|
| Backlash between any pair of gears | 0.08-0.18mm (0.003-0.007 in.) |
| Maximum permissible backlash between any pair of gears before reconditioning | 0.28mm (0.011 in.) |
| Injection pump adapter bearing end play | 0.114-0.152mm (0.0045-0.0060 in.) |
| Maximum permissible injection pump adapter bearing end play before reconditioning | 0.23mm (0.009 in.) |

## LUBRICATING OIL PUMP AND WATER PUMP

| | |
|---|---|
| Drive shaft end play | 0.13-0.25mm (0.005-0.010 in.) |
| Backlash between idler and body gears | 0.20-0.30mm (0.008-0.012 in.) |
| Radial clearance between gear and housing | 0.22-0.25mm (0.0085-0.0100 in.) |
| Drive shaft diameters: | |
| For oil pump pressure body bushing | 25.083-25.095mm (0.9875-0.9880 in.) |
| For water pump body bushing | 21.895-21.908mm (0.8620-0.8625 in.) |
| Oil pump pressure body bushing inside diameter (ream after assembly) | 25.15-25.17mm (0.990-0.991 in.) |
| Water pump body bushing inside diameter (ream after assembly) | 21.958-21.984mm (0.8645-0.8655 in.) |
| Oil pump idler shaft diameter | 21.933-21.946mm (0.8635-0.8640 in.) |
| Oil pump idler gear bushing inside diameter (ream after assembly) | 21.996-22.022mm (0.8660-0.8670 in.) |
| Running clearance (drive shaft and idler shaft) | 0.051-0.089mm (0.0020-0.0035 in.) |
| Maximum permissible running clearance | 0.15mm (0.006 in.) |
| Gear width: | |
| Water pump body gear and idler gear | 66.62-66.65mm (2.623-2.624 in.) |
| Oil scavenging pump body gear and idler gear | 52.261-52.286mm (2.0575-2.0585 in.) |
| Number of gear teeth per gear | 10 |

### AIR COMPRESSOR

Capacity at 1250 rpm – cubic feet per minute:
- TU-FLO-500 ..... 12
- TU-FLO 1000 ..... 24

Bore ..... 63.5 mm (2.5 in)
Stroke ..... 42.6 mm (1.69 in)

## 3. SPECIAL NUT AND BOLT TORQUE DATA*

| | |
|---|---|
| Cylinder head stud nuts ** | 407 N·m (300 ft-lbs) |
| Air compressor mounting bracket bolts (1/2 inch bolts for H-560 PAYloader) | 115 N·m (85 ft-lbs) |
| Cylinder head stud to crankcase *** | 102-360 N·m (75-265 ft-lbs) |
| Stud height (top of crankcase to top of stud) *** | |
| Short | 165 mm (6.5 in) |
| Long | 274.6 mm (10.81 in) |
| Center stud if equipped with crab | 198 mm (7.8 in) |
| Connecting rod nuts | 204 N·m (150 ft-lbs) |
| Camshaft gear bolts | 122 N·m (90 ft-lbs) |
| Main bearing cap bolts | 320 N·m (235 ft-lbs) |
| Flywheel bolt | 305 N·m (225 ft-lbs) |
| Cranking motor mounting bolts | 156 N·m (115 ft-lbs) |
| Intake and exhaust manifold nuts and cap screws | 102 N·m (75 ft-lbs) |
| Vibration damper hub nut: | |
| Nylon pellet nut | 475 N·m (350 ft-lbs) |
| Nylok patch nut | 542 N·m (400 ft-lbs) |
| Hydraulic pump idler gear bolt | 305 N·m (225 ft-lbs) |
| Fan hub retaining nut | 393 N·m (290 ft-lbs) |
| Fan drive gear nut | 835 N·m (615 ft-lbs) |
| Fan idler gear shaft bolt | 203 N·m (150 ft-lbs) |
| Fan hub retaining nut | 393 N·m (290 ft-lbs) |
| Fan drive retainer plate cap screws | 31 N·m (23 ft-lbs) |
| Hydraulic pump idler shaft bolt | 305 N·m (225 ft-lbs) |
| Injection nozzle crab bolt | 40 N·m (30 ft-lbs) |
| Air compressor pulley nut | 224 N·m (165 ft-lbs) |
| Valve housing bolt: | |
| w/aluminum clamps | 27 N·m (20 ft-lbs) |
| w/gray iron clamps | 47 N·m (35 ft-lbs) |
| Valve housing cover post | 75 N·m (55 ft-lbs) |
| Water pump mounting cap screws and nuts | 52 N·m (38 ft-lbs) |
| Injection pump drive gear nut | 217 N·m (160 ft-lbs) |
| Lube oil filter case cap screws | 27 N·m (20 ft-lbs) |
| Lubricating oil and water pump drive gear nut | 190 N·m (140 ft-lbs) |
| Air compressor mounting bolts | 81 N·m (60 ft-lbs) |
| Tachometer drive nut | 55 N·m (40 ft-lbs) |
| Crankshaft gear nut | 712 N·m (525 ft-lbs) |
| Crankshaft rear oil seal retainer cap screws (Nylok) | 27 N·m (20 ft-lbs) |
| Oil pan drain plug | 47 N·m (35 ft-lbs) |
| Alternator pulley nut | 102 N·m (75 ft-lbs) |
| Injection pump gear nut | 142 N·m (105 ft-lbs) |
| Fuel line nuts at injection pump | 40 N·m (30 ft-lbs) |
| Fuel line nuts at valve housings | 55 N·m (40 ft-lbs) |

* All torques are given with bolts, studs and nuts lubricated with clean engine oil except as noted.
** To be torqued in steps as shown on the cylinder head torque pattern chart in Section 2. Torque on center stud, if equipped with crab assembly, is 570 N·m (420 ft-lbs).
*** Cylinder head stud torque must be within given value to obtain proper height of stud.

# GENERAL

## 4. TORQUE VALUES FOR STANDARD FASTENERS

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Catalog for the machine involved. *DO NOT SUBSTITUTE.* Original equipment standard hardware is defined as IH Type 8, coarse thread bolts and nuts and thru hardened flat washers (Rockwell "C" 38-45), all phosphate coated and assembled without supplemental lubrication (as received condition).

The torques shown on the next page also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.
2. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts).
3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade *ONLY* and are *NOT* to be used to determine required torque.

| NOMINAL THREAD DIAMETER | STANDARD TORQUE ±10% | |
|---|---|---|
| | FOOT LBS. | NEWTON METERS |
| 1/4 | 7 | 10 |
| 5/16 | 14 | 19 |
| 3/8 | 24 | 32 |
| 7/16 | 38 | 51 |
| 1/2 | 60 | 80 |
| 9/16 | 80 | 110 |
| 5/8 | 115 | 155 |
| 3/4 | 200 | 270 |
| 7/8 | 320 | 440 |
| 1 | 480 | 650 |
| 1-1/8 | 590 | 800 |
| 1-1/4 | 830 | 1100 |
| 1-3/8 | 1100 | 1500 |
| 1-1/2 | 1400 | 1900 |
| 1-3/4 | 2300 | 3100 |
| 2 | 3400 | 4600 |

### TORQUE VALUES FOR HOSE CLAMPS

The following chart provides the tightening torques for hose clamps used in all rubber applications (radiator, air cleaner, operating lever boots, hydraulic system, etc.)

| CLAMP TYPE & SIZE | TORQUE PLUS OR MINUS 5 IN.-LBS (0.6 NM) | | | |
|---|---|---|---|---|
| | RADIATOR, AIR CLEANER, BOOTS, ETC. | | HYDRAULIC SYSTEM | |
| | INCH LBS. | NEWTON METERS | INCH LBS. | NEWTON METERS |
| "T" Bolt (Any Diameter) | 60 | 7 | 45 | 5 |
| Worm Drive — 1-3/4" Open Diameter & Under | 25 | 3 | 45 | 5 |
| Worm Drive — Over 1-3/4" Open Diameter | 45 | 5 | 45 | 5 |

## 5. LOCTITE RETAINING AND SEALING COMPOUNDS

*(Special Loctite data, if any, is shown in the specific section of this manual that is affected.)*

### GENERAL

#### Compound Description

These products are single component, self-curing, polyester compounds which remain liquid while exposed to air, and harden by chemical action into tough structural solids when confined between closely mated metal parts. These compounds will resist solvents, heat, shock and vibration and are intended to provide a positive seal against leakage, and shear strength resistance to loosening when used in the assembly of threaded, slip fit, or press fitted parts.

#### Loctite Grades (General Usage)

1. GRADE 262 or GRADE B (Yellow) — Straight threaded fasteners.

2. GRADE "AVV" or GRADE 277 — Straight threaded fasteners, higher strength for studs, etc.

3. PLASTIC GASKET — Use as seal between mating surfaces.

4. UNFILLED PIPE SEALANT (HVV) — Use on tapered pipe threads. DO NOT substitute grades or usage unless specified.

5. HYDRAULIC SEALANT — Fuel fittings, straight pipe threads.

#### Temperature Range

Once cured, these compounds have an operating temperature range of -65 to 300° F, and will resist attack by oils, chemicals, hydraulic fluids and solvents.

#### Exceptions — DO NOT Use Loctite:

1. Where other means of retaining the assembly are provided such as, prevailing torque fasteners (fasteners with distorted threads or plastic inserts), lock washers, lock plates and lock wires.

2. On items requiring frequent servicing.

3. When the operating temperature exceeds 300° F. (Example: Engine exhaust systems.)

4. On brass fittings and plugs.

### SURFACE PREPARATION

#### Plain and Phosphate Coated Parts

Clean the surfaces where compounds are to be applied to remove heavy coatings of oil, grease and dirt (rust or light oil film are not detrimental). Normal shop practice of cleaning or degreasing is adequate. Phosphate and oiled hardware is used in the "as received" condition.

#### Zinc or Cadmium Plated Parts or for Rapid Hardening

At least one of the mating surfaces should be degreased with a cleaning solution to which concentrated primer has been added. (1 part primer concentrate to 30 parts trichlorethylene or 1-1-1 trichlorethylene.) Allow surfaces to dry for 3 to 5 minutes before applying compound.

#### Drawbar Studs or Special Stud Applications

Degrease parts with a cleaning solution to which concentrated primer has been added. (1 part primer concentrate to 30 parts trichlorethylene or 1-1-1 trichlorethylene.) Allow surfaces to dry for 3 to 5 minutes before applying compound. In blind holes be sure to remove all chips and oils.

#### Face Sealant (Plastic Gasket)

Mating parts must be cleaned as for plain and phosphate coated parts.

### APPLICATION

#### Cap Screws and Pipe Threads

Fill the first 2 to 3 leading threads in area of engagement with compound. For large quantities of cap screws, may also be applied by tumbling method (refer to manufacturer's instructions).

#### Studs

Apply by hand to individual studs. Fill full length of thread with one strip on diameters up to 1 inch, two strips 180° apart on diameters up to 2 inches, and three strips 120° apart on diameters over 2 inches. In all cases apply one strip into tapped holes.

Blind hole applications — apply enough compound to fill the bottom 2 to 3 threads of engagement, then insert stud. If engagement length exceeds one diameter use proportionally more compound.

For non-seated studs (studs that can go deeper in hole than required) turn stud one turn deeper than

required. After bubbling stops, apply a ring of compound around stud at top of hole, then turn back to required height.

**Primers**

Apply primer to surface where sealant is to be applied. Allow primer solvent to evaporate 3-5 minutes before applying adhesive. When adhesive is applied to a primed surface, parts should be assembled within 3 minutes.

**Face Sealant (Plastic Gasket)**

Spread an even coat (1 cc per 40 sq. inches) on one of the mating surfaces. Assemble and tighten bolts.

**NOTE:** *On crawler tractor applications only, when compound is used as a gasket, bolts which attach the parts should be coated with MPL (gear lubricant) to prevent compound from sticking to bolts.*

**SETTING TIME (BEFORE PLACING IN OPERATION)**

1. Normal time for compound grades without use of any primer — 6 to 24 hours at room temperature with machined carbon steel parts. Higher temperatures will accelerate cure and lower temperatures will retard cure. Other base metals will provide more or less catalytic effect on cure.

2. Primed surfaces — 2 to 6 hours. This may be speeded by pretreating mating surfaces with special primers. Some metals (such as zinc and cadmium plate, anodized aluminum, and passivated stainless steel) are inactive and require heat or primer to cure the compound.

3. A fast curing type primer will fix parts for normal handling in 10 to 15 minutes and will achieve 75 percent of ultimate strength in 1 hour and full cure in 2 to 4 hours.

**REMOVAL**

Parts difficult to remove can be preheated to 205° to 260° C (400° to 500° F) prior to removal.

**APPLICATION AT LOW TEMPERATURES**

1. Without special precautions, these compounds can be applied and will cure at temperatures down to 10° C (50° F), and at that temperature full strength will be obtained within 72 hours.

2. At temperatures from 10° to -18° C (50° to 0° F) only a job-identified compound with the use of a primer can be recommended.

3. If necessary, the compounds can be applied at temperatures below -18° C (0° F), only if heat is used to accelerate the cure as follows:

66° C (150° F) for 60 minutes
93° C (200° F) for 45 minutes
121° C (250° F) for 30 minutes

## 6. SERVICE DIAGNOSIS

Service diagnosis is a systematic procedure of investigation to be followed in order to locate and correct an engine problem. The engine is first considered as a complete unit in its specific application and then the problem is localized to components or systems; intake, exhaust, cooling, lubrication or injection. Testing procedures will then help analyze the source of the problem.

Prerequisites for effective diagnosis:

1. Knowledge of the principles of operation for both the engine and application systems.

2. Knowledge to perform and understand all procedures in the diagnostic and service manuals.

3. Availability of and the ability to use gauges and diagnostic test equipment.

4. Have available the current Guideline Data for the engine application.

Although the cause of an engine failure may be apparent, very often the real cause is not found until a repeat failure occurs. This can be prevent-

ed if specific diagnostic action is taken prior to, during and after engine disassembly and during engine reassembly.

It is also very important that specific diagnostic tests follow engine reassembly prior to and after the engine is placed back into service.

Refer to Diagnostic Manual ISS-1526 for Engine Data Guidelines for Pay Line Applications. For component specifications, refer to Par. 2 in this section. Also refer to Service or Product Information Bulletins to assure the use of latest specifications and procedures.

The visual inspections and measurements required will determine not only the need to replace a component but also for salvage such as the crankcase for cylinder sleeve upper and lower bore inserts.

It is recommended that you follow the steps outlined in the areas listed below when the need to perform engine repairs becomes necessary. This will avoid unnecessary repairs, pin-point the cause or causes of failure and eliminate repeat failure.

PRIOR TO REMOVAL OF ENGINE FROM CHASSIS OR PERFORMING IN-CHASSIS DISASSEMBLY.

PRIOR TO ENGINE DISASSEMBLY.

DURING ENGINE DISASSEMBLY.

PRIOR TO ENGINE REASSEMBLY.

DURING ENGINE REASSEMBLY.

PRIOR TO ENGINE START-UP.

ENGINE START-UP.

**PRIOR TO REMOVAL OF ENGINE FROM CHASSIS OR PERFORMING IN-CHASSIS DISASSEMBLY**

1. Visually inspect for leakage, radiator clogging and note any other obvious defects.

2. Steam clean engine and visually inspect for additional defects – casting cracks, hoses, hose clamps and obvious damage to components such as mounting brackets, fan and shroud, etc.

3. Obtain In-Chassis Engine Performance Data.

4. Pressure test air induction system.

5. Obtain a sample of the crankcase oil and submit for analysis.

**NOTE:** *If sample is not submitted under OLA program and local laboratory is used, it will be necessary for you to specify type of analysis required.*

6. Obtain a coolant sample and hold pending inspection of engine components after disassembly, as condition will dictate if this sample should be discarded or analyzed.

**PRIOR TO DISASSEMBLY OF ENGINE**

1. Pressure check engine cooling system for leaks if evidence of lube oil and coolant intermixing is found. Refer to Diagnostic Manual.

**DURING ENGINE DISASSEMBLY**

1. Measure and record exhaust and intake valve lash.

2. Measure and record cylinder head bolt (nut) torque using the mark method.

3. Measure and record connecting rod and main bearing cap bolt torque using the mark method.

4. Measure gear backlash if the front cover is removed.

5. Measure and record crankshaft end play.

6. Inspect push rods for straightness and end button looseness.

7. Inspect valve tappets for defects.

**PRIOR TO ENGINE REASSEMBLY**

1. Pressure test cylinder head(s) for nozzle sleeve leakage and port and/or deck cracking if Magnaflux, Magnaglo or visual inspection did not reveal cracks.

2. Pressure test oil cooler for leakage.

# GENERAL

3. Measure cylinder head lower deck flatness.

4. Inspect the valve seat inserts for wear, cracks and looseness.

5. Measure valve guides for excessive wear.

6. Inspect valves for stem and face wear, face burning and cracks.

7. Inspect valve rotators for operation.

8. Measure crankcase deck for flatness.

9. Inspect crankcase deck for cracks.

10. Inspect cylinder sleeve counterbores for cracks.

11. Measure cylinder sleeve counterbores.

12. Inspect lower cylinder sleeve bores for erosion.

13. Measure lower cylinder sleeve bores.

14. Inspect camshaft bearings for wear and looseness.

15. Inspect oil gallery(s) for foreign material.

16. Inspect oil pressure regulating and bypass valves for scuffing and sticking.

17. Inspect turbocharger for oil seal leakage and wheel damage.

18 Measure turbocharger shaft end and radial movement.

19. Inspect oil pump suction and pressure side pipes for cracks, end fretting, gasket and/or "O" ring failure. Inspect screen for damage and restriction.

20. Inspect crankshaft for cracks on the throws and journals. Inspect journals for scuffing and scratching.

21. Inspect water pump for seal, bearing and impeller failure.

22. Inspect oil pump for seal, bearing and gear failure.

23. Flow test injection pump if permitted under injection pump service policy to determine if fuel delivery meets specifications and if repair or replacement is required.

24. Test injection nozzles for orifice plugging, tip leakage and opening pressure. It is suggested that nozzles be disassembled and cleaned or new valves installed or that nozzles be replaced with ReNEWed assemblies (see NOTE).

**NOTE:** *If nozzle life has been short and if inspection reveals metal chips in orifices, the injection lines (all) should be replaced.*

## DURING ENGINE REASSEMBLY

1. Measure cylinder sleeve flange protrusion.

2. Measure piston ring gap.

3. Rectangular rings: Measure piston ring side clearance.

4. Keystone rings: Measure piston ring drop.

5. Measure connecting rod and main bearing to crankshaft journal clearance.

6. Measure intake and exhaust valve protrusion or recession.

7. Measure nozzle tip protrusion.

8. Lubricate camshaft and face of valve tappets with Molycote "G-n" paste or Fel-Pro C-670.

9. Lubricate O.D. of tappets with oil.

## PRIOR TO ENGINE START-UP

1. Pressurize lubrication system with engine oil to assure adequate lubrication.

**NOTE:** *Remove valve cover(s) and check for oil flow to rocker arm assembly.*

2. Pressure test air induction system.

## ENGINE START-UP

1. Run at low idle and check rocker arm lubrication. Reinstall valve cover(s).

2. Inspect visually for coolant and oil leaks.

3. Start engine run-in (see NOTE).

**NOTE:** *Follow specified engine run-in procedure. Failure to do so will result in engine failure such as piston/sleeve scoring and/or excessive oil consumption.*

4. Retorque cylinder heads at specified time period during run-in. Failure to do so will result in head gasket failure.

5. Complete engine run-in.

6. Obtain In-Chassis Engine Performance Data.

7. Retorque all external fasteners (nuts, bolts and hose clamps).

8. Engine can now be placed back into service.

**NOTE:** *Follow-up should be made per after delivery service for specific application. This follow-up service must be made on engine if complete engine disassembly was necessary.*

## 7. PROBLEM ANALYSIS USING DIAGNOSTIC GUIDELINES

**PROBLEM: Low Intake Manifold Pressure (Power Complaint)**

**REASON OR CAUSE:**

1. External leakage on intake or exhaust manifolds at gasket, slip-joints, cracks or line connections, at fuel modulator (Aneroid) and air compressor – turbocharger connections and turbocharger housing clamps.
2. Excessive air cleaner restriction.
3. Excessive exhaust back pressure after turbocharger.
4. Plugged injection nozzles.
5. Plugged or restricted fuel filters.
6. High vacuum on low pressure fuel system caused by fuel hose collapse, incorrectly drilled connectors; wrong fuel filter elements, foreign material in fuel tank.
7. High crankcase pressure by worn piston ring, sleeves or leaking cylinder head gasket.
8. Defective or improperly adjusted injection pump fuel modulator (Aneroid).
9. Defective injection pump – under fueling.
10. Torque converter slipping, high converter stall speed.
11. Excessive main hydraulic pressure causing low full stall speed.
12. Wrong injection pump on engine.
13. Incorrect turbine housing A/R ratio or nozzle ring.

# GENERAL

**PROBLEM: High Intake Manifold Pressure (Excessive Fuel Consumption)**

REASON OR CAUSE:

1. Overfueling of engine caused by defective or misadjusted fuel injection pump.
2. Incorrect turbine housing (incorrect A/R ratio) or incorrect nozzle ring, small vane gap.
3. Incorrect nozzles - orifice size larger than specified for application.
4. Incorrect injection lines - I.D. larger than specified for application.

**PROBLEM: Excessive Engine Speed (RPM)**

REASON OR CAUSE:

1. Inaccurate tachometer.
2. Misadjusted injection pump.
3. Defective injection pump.

**PROBLEM: Escessive Crankcase Pressure**

REASON OR CAUSE:

1. Dirty or restricted crankcase breather element.
2. Worn piston/sleeve due to dirt.
3. Cylinder head gasket leakage.
4. Broken piston rings due to wear.
5. Stuck piston rings due to incorrect specification lube oil.
6. Improper maintenance procedures.

**PROBLEM: High Coolant Temperature**

REASON OR CAUSE:

1. Defective gauge.
2. Low coolant level.
3. Collapsed coolant hose(s).
4. Defective radiator - plugged tubes or fins.
5. Stuck thermostats.
6. Improper coolant treatment.
7. Defective water pump.
8. External water leakage.
9. Loose fan belts - slipping.
10. Defective pressure relief valve.
11. Overfueling.

**PROBLEM: Low Coolant Temperature**

REASON OR CAUSE:

1. Defective gauge.
2. Incorrect thermostats.
3. Defective thermostat seals or thermostat housing counterbore.
4. Shutterstats inoperative.
5. Stuck thermostats.

**PROBLEM: Excessive Exhaust Smoke – Black**

REASON OR CAUSE:

1. Low power.
2. Defective turbocharger.
3. Excessive air cleaner restriction.
4. Intake manifold pressure leakage.
5. Plugged nozzles - low opening pressure.
6. Overfueling due to misadjustment.
7. Lugging engine.
8. Low compression - worn piston rings/cylinder sleeves.
9. Defective injection pump.
10. High crankcase pressure - broken piston rings.
11. High main hydraulic pressure - low stall speed.
12. Fuel modulator (aneroid) failure - low stall speed.

**PROBLEM: Excessive Exhaust Smoke – Gray**

REASON OR CAUSE:

1. Worn piston ring or cylinder sleeves.
2. Excessive air cleaner restriction.
3. Worn valve guides.

**PROBLEM: Excessive Exhaust Smoke – White**

REASON OR CAUSE:

1. Overfueling when engine is cold.
2. Defective injection pump starting devices.

# GENERAL

**PROBLEM: Low Fuel Supply Pressure**

**REASON OR CAUSE:**

1. Dirty or restricted fuel filter element.
2. Restricted or leaking low pressure fuel lines from fuel tank to inlet of supply pump.
3. Defective supply pump - regulative valve inoperative.
4. Defective fuel return valve.

**PROBLEM: Excessive Air inlet Restriction**

**REASON OR CAUSE:**

1. Dirty element - soot - poor maintenance.
2. Damaged element.
3. Incorrect size element.
4. Damaged inlet piping.

**PROBLEM: Engine "Misfiring" - Erratic Visual Smoke**

**REASON OR CAUSE:**

1. Plugged nozzle orifices (holes).
2. Low nozzle valve opening pressure.
3. Improper valve lash.
4. Valves and/or seats wear leakage.
5. Cylinder head gasket leakage.
6. Defective injection pump.
7. Incorrect valve timing.
8. Air in fuel system.

**PROBLEM: Excessive Back Pressure After Turbocharger**

**REASON OR CAUSE:**

1. Damaged muffler.
2. Damaged exhaust pipe.
3. Wrong muffler.
4. Excessive length and/or bends in exhaust piping.

best copy available

**NOTE 1:** Refer to Service Manual ISS-1540 for specifications, operation, maintenance and repair of International Alternators.

**NOTE 2:** For detailed information on the repair, test and adjustment of Delco-Remy components, refer to Delco-Remy Service Manual Form No. 1.2.

**NOTE 3:** Refer to CTS-2001 for on-highway truck applications.

**PROBLEM: Discharging Battery**

**REASON OR CAUSE:**

1. Connections loose.
2. Short circuits.
3. Connections dirty.
4. Voltage control unit out of order.
5. Alternator not charging.

**PROBLEM: Battery Overheating**

**REASON OR CAUSE:**

1. High charging rate.
2. Voltage control unit out of order.

**PROBLEM: Batteries Fully Charged and Alternator Charging Rate High**

**REASON OR CAUSE:**

1. Improper voltage regulator setting.
2. Grounded alternator field circuit (in either alternator, regulator or wiring).

**PROBLEM: Batteries Low in Charge and Low or No Alternator Charging Rate**

**REASON OR CAUSE:**

1. Loose connections, frayed or damaged wiring.
2. Defective batteries.
3. Low voltage regulator setting.
4. Oxidized regulator contact points.
5. Defective alternator.

**PROBLEM: No Alternator Output**

**REASON OR CAUSE:**

1. Defective Alternator.

**PROBLEM: Ammeter Shows Discharge with Engine Operating**

**REASON OR CAUSE:**

1. Alternator inoperative.
2. Faulty voltage regulator.
3. Short circuits.
4. Alternator drive belt loose or broken.

# GENERAL

**PROBLEM: Noisy Alternator**

**REASON OR CAUSE:**

1. Loose mountings.
2. Loose pulley.
3. Worn bearings.

**PROBLEM: Ammeter Pointer Fluctuates Rapidly**

**REASON OR CAUSE:**

1. Shorted or loose connections.
2. Alternator defective.
3. Alternator drive belt loose or broken.
4. Low idling speed.

**PROBLEM: Volt-Meter Shows Less than 26 Volts with Engine at High Idle**

**REASON OR CAUSE:**

1. Alternator inoperative.
2. Faulty voltage regulator.
3. Defective connections.

**PROBLEM: High Voltage - Volt-Meter Pointer in Red Zone**

**REASON OR CAUSE:**

1. Grounded alternator field circuit - in either alternator, regulator or wiring.
2. Defective regulator.

**PROBLEM: Cranking Motor Will Not Operate or Operates Slowly**

**REASON OR CAUSE:**

1. Faulty batteries.
2. Cables or terminals loose, dirty or defective.
3. Starting switch defective.
4. Cranking motor burned out.
5. Commutator worn or dirty.
6. Brushes not making proper contact.
7. Starter solenoid defective.
8. Drive end bearing badly worn.

## 8. BATTERY TESTING CHART

| HYDROMETER TEST (80° F) (See NOTE) | CONDITION | REMEDY |
|---|---|---|
| 1.250 to 1.280 SPECIFIC GRAVITY | Charged. | No remedy required if variation among cells is not over .015 Sp. Gr. If variation is much more than .015 Sp. Gr., give high rate discharge test. If cells test OK recharge test. If cells test OK recharge and adjust gravity of all cells uniformly. |
| 1.225 to 1.250 SPECIFIC GRAVITY | Fair. | Advisable to recharge, especially in cold weather. Adjust gravity of cells if not uniform. Check operation and setting of voltage regulator. Make a thorough check of the electrical system for short circuits, loose connections, and corroded terminals. |
| LESS THAN 1.225 SPECIFIC GRAVITY | Poor. | Battery must be recharged. Adjust gravity of cells if not uniform. Check operation and setting of voltage regulator. Make a thorough check of the electrical system for short circuits, loose connections, and corroded terminals. |
| CELLS SHOW MORE THAN 25 POINTS (.025 SP. GR.) VARIATION IN GRAVITY | Short circuit in low cell. Loss of electrolyte by leakage or excessive overcharge. Improper addition of acid or "dopes". Natural or premature failure. | Try to recharge battery at rate of one ampere for each positive plate in one cell until gravity readings show no rise in three consecutive readings when taken one hour apart. Cell voltage on charge should also be fairly uniform. Adjust gravity of cells to 1.280-1.290 at 80° F by addition of water to lower or 1.400 Sp. Gr. acid to raise the gravity of the acid. Make high rate discharge test after not less than 12 hours and not more than 96 hours standing on open circuit, and check discharge voltage of each cell. If more than .15 volt between cells is shown on discharge, the battery may be considered to be no longer serviceable. |

**NOTE:** *Electrolyte level must be 1/4 to 1/2 inch above the separators. Do not take the reading after adding water. Hydrometer readings must be corrected for temperature if temperature is extremely low or high.*

| VOLTMETER TEST | CONDITION | REMEDY |
|---|---|---|
| IF THE VOLTAGE DROP IS MORE THAN .2 VOLT (2/10)* BETWEEN THE CRANKING MOTOR CABLE AND THE FRAME WHILE CRANKING. | Poor contact between terminal and frame or between clamp terminal and battery post. | Locate the high resistance; repair or replace. |
| WHILE OPERATING THE CRANKING MOTOR WITHOUT IGNITION TURNED ON CHECK THE VOLTAGES OF ALL CELLS. (THIS TEST CAN ALSO BE DONE ON THE HIGH RATE TESTER.) IF THE VOLTAGE VARIES MORE THAN .15 VOLT BETWEEN CELLS. | Defective cell or cells. | Compare voltage readings with hydrometer readings – low voltage is usually accompanied by low gravity. Apply remedy given for "Cells show more than 25 points (.025 Sp. Gr.) variation in gravity." |

* The value of 2/10 is approximate and while cranking at room termperature.

## 9. ELECTRICAL TEST SPECIFICATIONS

**NOTE:** *For detailed instructions on repair, test and adjustment of the Delco-Remy alternator, cranking motor and voltage regulator, refer to Delco-Remy Service Manual, Form No. 1.2. Delco-Remy manuals may be purchased from United Motors Service Division of General Motors Corp., Detroit Michigan. For detailed instructions on repair, test and adjustment of the IH Alternator, refer to IH Service Manual ISS-1540.*

| Delco-Remy Voltage Regulator Model | Polarity | TEMPERATURE — VOLTAGE CHART | | | | |
|---|---|---|---|---|---|---|
| | | Regulator Ambient Temperature | 65° F | 85° F | 105° F | 125° F |
| 1119518 | N | Voltage Setting | 27.7-29.8 | 27.4-29.4 | 27.1-29 | 26.8-28.5 |

| Alternator Model | Alternator Model Number | Ground | Rotation Viewing Drive End | Field Current (80° F) | | COLD OUTPUT AT SPECIFIED VOLTAGE | | | | | Rated Hot Output (Amps) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Amps | Volts | Spec. Volts | Amps | Approx. RPM | Amps | Approx. RPM | |
| Delco-Remy | 1100061 | N | EITHER | 1-1.1 | 24 | 28 | 16 | 2000 | 30 | 5000 | 30 |
| | 1100062 | N | EITHER | 1-1.1 | 24 | 28 | 10 | 2000 | 21 | 5000 | 20 |
| | 1117236 | N | EITHER | 2.5-2.9 | 24 | ‡ | – | –– | 54 | 5000 | 50 |
| | 1117248 | N | EITHER | 2.5-2.9 | 24 | ‡ | – | –– | 54 | 5000 | 50 |
| I.H. | 683 728 C91 | N | EITHER | 2.0-2.4 | 24 | 28 | 16 | 2000 | 47 | 6000 | 45 |

‡ Voltmeter not needed for cold output check. Load battery with carbon pile to obtain maximum output.

| Cranking Motor Model Number | Make | Type of Drive | No Load Test | Lock Test | Rotation (View from drive end) | Brush Spring Tension (ounces) | No. of Brushes | Bearings | No. of Fields | Volt. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1113831 | D.R. | Over-running Sprag clutch | 75-95 amps 20 volts at 5500 7500 rpm | 26 ft-lbs at 500 amps at 3.5 volts. | Clockwise | 80 (Min) | 8 | Bushing Type | 4 | 24 |
| 1113883 or 1113905 | D.R. | Over-running Sprag Clutch | 75-95 amps at 20 volts at 5500 7500 rpm | 26 ft-lbs at 500 amps at 3.5 volts. | Clockwise | 36 | 8 | Bushing Type | 4 | 24 |

## 10. TUNE-UP

### GENERAL

The following steps outline the operations which must be followed in an engine tune-up. These steps point out the various parts of the engine to be checked, cleaned, timed or repaired, as needed.

### INJECTION PUMP

Check the injection pump for correct timing and operation.

### FUEL INJECTION NOZZLES

Remove the injection nozzles and check for leaks and opening pressures. Refer to Par. 10 in Section 9.

### ENGINE THROTTLE CONTROL

1. Check the operation of the control.

2. Check the operation of the springs on the governor control rod.

3. Check the rpm of the engine, using a tachometer.

### VALVES

Check the clearance on intake and exhaust valves, and make adjustments. Check valve bridges. (Refer to "VALVE ADJUSTMENTS" in Section 2.)

### AIR CLEANER

1. Check the air cleaner and connections for possible leaks.

2. Service the air cleaner as described in the Operator's Manual.

### FILTERS

1. Replace the lubricating oil filters.

2. Inspect the fuel filter elements and replace them if necessary. (Refer to the Operator's Manual.)

### ALTERNATOR

1. Inspect the alternator; clean thoroughly at frequent intervals.

### CRANKING MOTOR

1. Inspect the commutator; clean thoroughly at frequent intervals.

### ELECTRICAL CONNECTIONS

1. Check all electrical connections.

2. Check all switches.

### COOLING SYSTEM

1. Flush the radiator with clean water, then drain. Refill with soft water if available or anti-freeze solution in cold weather.

2. Check the alternator and air compressor belts (if equipped) for wear and adjust tension or replace if necessary.

### TURBOCHARGER

Check the operating condition of the turbocharger. Refer to "TURBOCHARGER SERVICE MANUAL" ISS-1047 for detailed information.

## 11. SPECIAL SERVICE TOOLS REQUIRED

| SECTION USED IN | DESCRIPTION | TOOL NUMBER* |
|---|---|---|
| 2 | Cylinder Head Water Test Kit<br>Injector Nozzle Sleeve Puller<br>Injector Sleeve Bottoming Tool<br>Injector Liner Rolling Tool<br>Injector Sleeve Reamer and Guide Bushing<br>Depth Gauge**<br>Spring Load Tester<br>Adapter (for pressure testing valve housing-to-injection nozzle lines) (Part of PLT-365-2) | PLT-508<br>PLT-507-3<br>PLT-507-4<br>PLT-507-1<br>PLT-507-2<br>1 020 560 R91<br>PLT-100<br><br>4092 |
| 3 | Piston Ring Clearance Fixture<br>Connecting Rod Bushing Removal and Installing Tool<br>Cylinder Sleeve Puller Set<br>Cylinder Sleeve Counterboring Tools<br>Driver<br>Adapter<br>Holder<br>Extension<br>Oil Leak Detector | PLT-501<br>PLT-544-1<br>PLT-502-3<br><br>1 020 553 R91<br>1 020 554 R91<br>1 020 557 R1<br>1 020 563 R1<br>SE-1632 |
| 4 | Rear Oil Seal Installing Tool | PLT-513-7A |
| 5 | Vibration Damper Puller<br>Sleeve Drive<br>Wrench Adapter | PLT-506<br>PLT-542<br>PLT-518 |
| 9 | Seal Pliers<br>Holding Tool*** | PLT-371-4<br>1 020 327 R1 |

* Order all tools from:

International Harvester Company
Parts and Service Development Department
600 Woodfield
Schaumburg, Illinois 60196

** Also used in Section 3.
*** Holding tool no longer available.

## MANIFOLDS

### 1. REMOVAL (Refer to Fig. 1 or 2)

1. Remove the exhaust elbow (1) and turbocharger exhaust sleeve.

**NOTE:** *The exhaust sleeve (not illustrated) is loosely held between the exhaust elbow and the turbine housing. The sleeve must be held as the elbow is removed, to prevent the sleeve from dropping.*

2. Disconnect the turbocharger oil inlet and oil drain tubes from the turbocharger.

3. DT ENGINES: Disconnect the hose (21) between the turbocharger compressor housing (22) and air discharge elbow (14). Remove the bolts, nuts and washers securing the air discharge elbow to the intake manifold.

DTI ENGINES: Disconnect the hose (21) between the turbocharger compressor housing (22) and intercooler air inlet elbow (20).

4. Remove the mounting nuts securing the turbocharger to the exhaust manifold. Lift off the turbocharger.

5. DTI ENGINES: Drain the cooling system to the level of the intercooler. Disconnect the intercooler water inlet hose (7) from the intercooler.

6. Remove the filter tube (13) and oil level gauge sleeve (10).

**Fig. 1. Turbocharger Connections and Manifolds (DT-817 SERIES C Engine)**

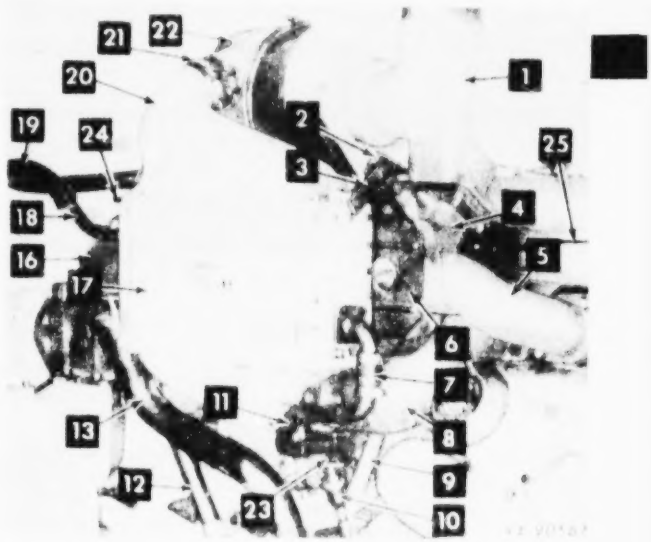



**Fig. 2. Turbocharger Connections, Intercooler Connections and Manifolds (DTI-817 SERIES C Engine)**

**Legend for Figs. 1 and 2**

1. Exhaust Elbow
2. Intercooler Support (*)
3. Intercooler Support Strap (*)
4. Exhaust Manifold (front intermediate)
5. Exhaust Manifold (front)
6. Intercooler Heat Shield (*)
7. Intercooler Inlet Hose (upper) (*)
8. Intake Manifold
9. Turbocharger Oil Drain Tube
10. Oil Lever Gauge Sleeve
11. Intercooler Inlet Pipe (*)
12. Breather Pipe
13. Crankcase Oil Filler Pipe
14. Turbocharger Air Discharge Elbows (+)
15. Exhaust Manifold (rear intermediate)
16. Exhaust Manifold (rear)
17. Intercooler (*)
18. Intercooler Water Outlet Pipe (*)
19. Rear Water Manifold-to-Intercooler Water Outlet Pipe Hose (*)
20. Intercooler Air Inlet Elbow (*)
21. Hose
22. Turbocharger Compressor Housing
23. Intercooler Inlet Hose (lower) (*)
24. Turbocharger Oil Inlet Tube
25. Fuel Return Line

(*) DTI Engines Only
(+) DT Engines Only

# MANIFOLD, CYLINDER HEADS AND VALVES

7. Remove the breather pipe (12).

8. DTI ENGINES: Disconnect the intercooler water outlet hose (19) from the rear water manifold and intercooler water outlet pipe (18).

9. DTI ENGINES: Remove the intercooler as follows:

a. Disconnect the strap (3) from the intercooler.

b. Disconnect the intercooler inlet pipe hose (7) from the intercooler outlet elbow.

c. Remove the crankcase oil filler pipe (13).

d. Remove the hardware securing the intercooler (17) to the intake manifold (8) and remove intercooler (Fig. 3). The heat shield (6) will come off with the intercooler.

10. Remove the nuts securing the exhaust manifolds to the cylinder heads and remove the exhaust manifolds as a unit.

11. Remove the nuts and bolts securing the intake manifold to the cylinder heads and remove the manifold.

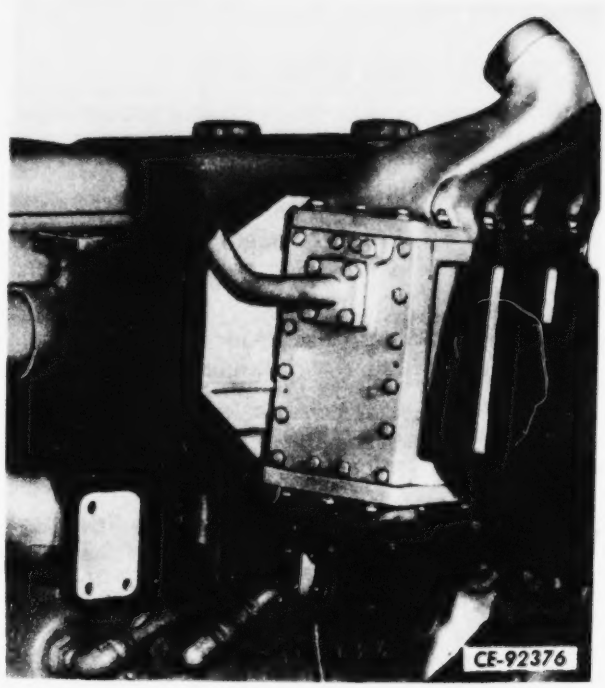



**Fig. 3. Removing Intercooler**

## 2. INSPECTION AND REPAIR

1. Steam clean the intake and exhaust manifolds to remove all dirt and carbon accumulaton.

2. Inspect the intake manifold, exhaust manifold sections and flanges for cracks and distortions. Replace where necessary.

3. Discard the old intake and exhaust manifold gaskets and clean the cylinder head gasket surfaces thoroughly.

## 3. INSTALLATION

Install manifolds and turbocharger and intercooler in the reverse order of removal. Use new gaskets and torque the intake and exhaust bolts and nuts to 102 N.m (75 ft-lbs).

**NOTE:** *After all connections have been made, fill and vent the cooling system as described in the Operator's Manual.*

**Legend for Fig. 4**

1. Valve Housing Cover (rear)
2. Cover Screw
3. Valve Housing Cover (front)
4. Gasket
5. Valve Cover Housing
6. Gasket
9. Valve Housing Clamp
10. Valve Spring Keys
11. Valve Rotator
12. Valve Spring
13. Lower Valve Spring Guide
14. Valve Guide
15. Valve Seat Insert
16. Valve
17. Valve Lever Bracket (rear)
18. Roll Pin
20. Plug
21. Valve Lever Shaft
22. Cylinder Head Stud Nut
23. Washer
24. Plug
25. Valve Lever Bracket (intermediate)
26. Lock Nut
27. Valve Lever Adjusting Screw
28. Valve Lever
29. Bushing
33. Valve Lever Spacer
34. Valve Lever Bracket (front)
38. Nozzle Crab Screw
39. Washer
40. Nozzle Crab
41. Nozzle Crab End Support
42. Valve Lever Bridge
43. Valve Lever Bridge Screw
44. Nut
45. Cylinder Head (front)
46. Plug
47. Cylinder Head Water Vent Plug Director
48. Plug
49. Cylinder Head Gasket
50. Water Transfer Tube
51. Nut
52. Connector
53. Cylinder Head (rear)
54. Intake and Exhaust Manifold Stud
55. Valve Housing Cover Post
56. Valve Bridge Guide
57. Nozzle Sleeve

## CYLINDER HEADS AND VALVES

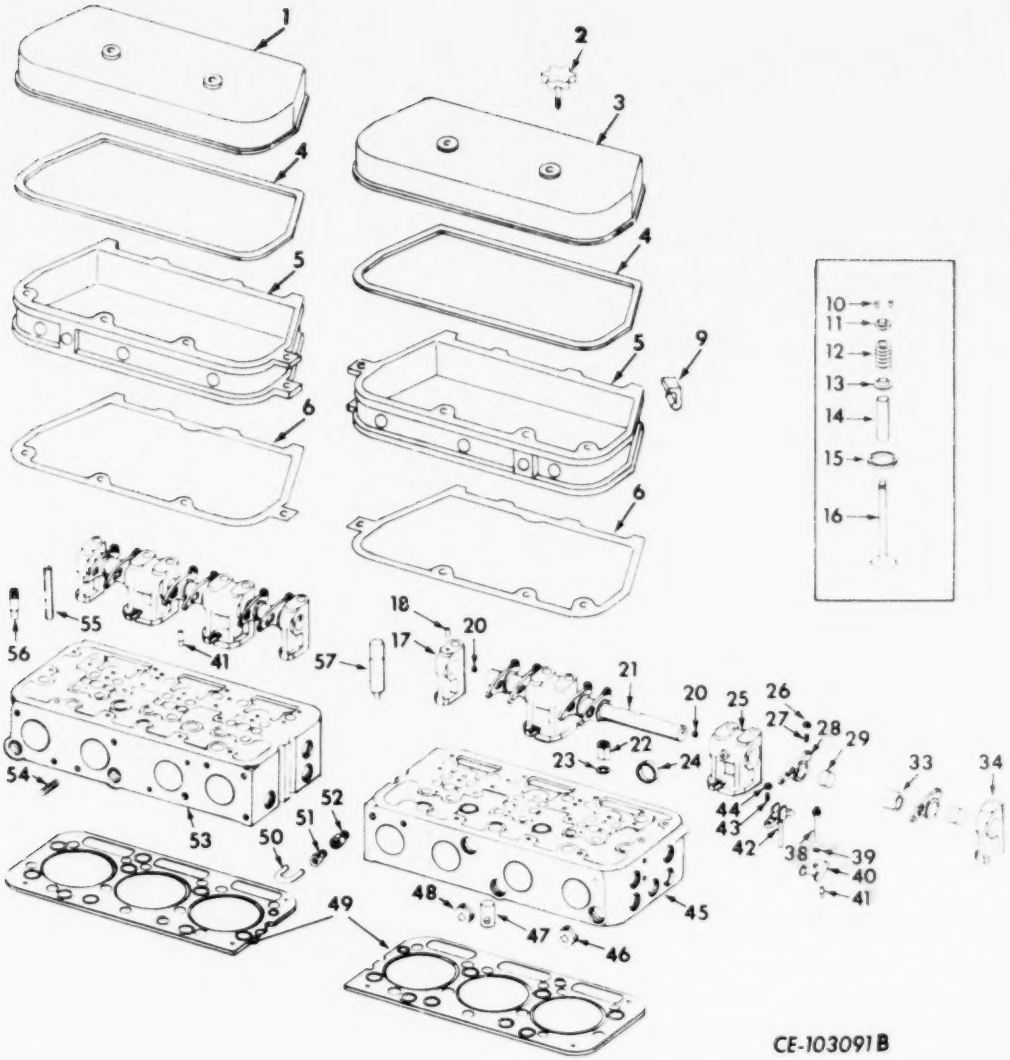



Fig. 4. Exploded View of Cylinder Heads, Valves and Related Parts

# MANIFOLD, CYLINDER HEADS AND VALVES

## 4. DESCRIPTION

Each cylinder head contains six intake and six exhaust valves (two of each per cylinder). Positive valve rotators and valve seat inserts are used on all valves.

There are three fuel injection nozzles in each cylinder head, one between each pair of intake and exhaust valves. To insure efficient cooling, the nozzles are inserted into a thin-walled copper tube, passing through the water space in the cylinder head.

The rocker arm assembly on each head is mounted on four brackets and is located and held down by the cylinder head studs and nuts. There are two rocker levers per cylinder, one for each pair of intake and exhaust valves. A valve bridge connects each pair of intake and exhaust valves which allows both valves to be actuated by one rocker lever.

Both cylinder heads are basically of uniform construction, however, slight modification in design prevent them from being interchangeable. A separate cylinder head gasket with integral gasket rings is provided for each head.

## 5. REMOVAL

**NOTE:** *The following procedure covers the removal of both cylinder heads. When removing just one cylinder head, remove the half of the water manifold secured to the cylinder head being removed. Also, it will not be necessary to remove the lubricating oil filters, final fuel filter and fuel reservoir (if equipped) to remove the front cylinder head.*

1. Drain any remaining coolant in the engine by opening the water drain valve in the engine block.

2. Remove the intake and exhaust manifold. (Refer to Par. 1.) Remove the water transfer tube (50, Fig. 4).

3. Disconnect and remove the turbocharger oil inlet tube.

4. Units equipped with fuel reservoir: Remove the fuel reservoir and final fuel filter as follows (refer to Fig. 5):

   a. Disconnect the hose (1) at the header (8).

   b. Disconnect the tube (6) at the header (4).

   c. Disconnect the tube (9) at the header (8).

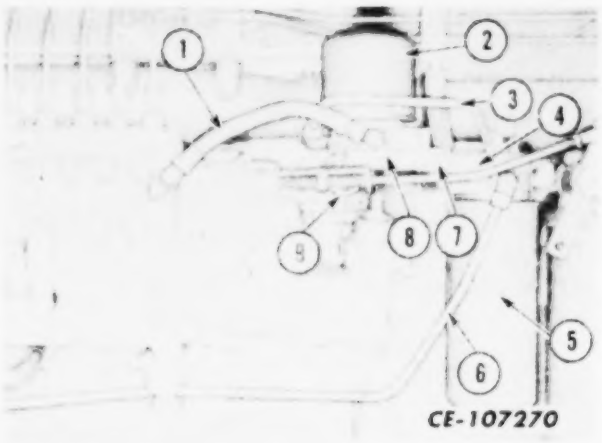



**Fig. 5. Final Fuel Filter and Fuel Reservoir Connections**

1. Fuel Reservoir-to-Injection Pump Hose
2. Fuel Reservoir
3. Final Fuel Filter-to-Fuel Reservoir Tube
4. Final Fuel Filter Header
5. Final Fuel Filter
6. Final Fuel Filter-to-Supply Pump Tube
7. Fuel Reservoir Support
8. Fuel Reservoir Header
9. Fuel Reservoir Bleed Tube

   d. Remove the two bolts and washers securing the header (4) to the support (7). Remove the support; then remove the headers (4 and 8) with filter (5) and reservoir (2) as a unit (Fig. 6).

   e. Tape or cover the open ends of the tubes, hose and connectors.

5. Units without fuel reservoir: Remove final fuel filter as follows (refer to Fig. 6):

   a. Disconnect the hose (1) at the header (3).

   b. Disconnect the tube (5) at the header (3).

   c. Remove the bolts securing the header (3) to the support (2).

   d. Tape or cover the open ends of the tube, hose and connectors.

6. Disconnect the fuel injection lines at the injection pump and valve housings. Remove the two screws and washers securing the fuel line bracket to the front water manifold and remove the fuel lines and bracket as an assembly (Fig. 8).

Cap the openings at the injection pump and valve housings. Tape or cover the open ends of the fuel lines.

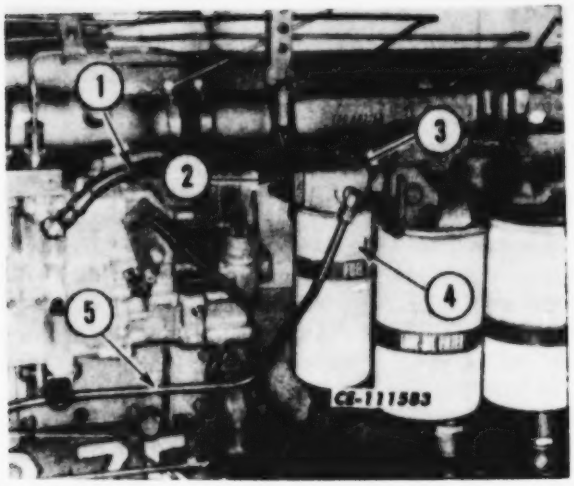



**Fig. 6. Final Fuel Filter (Without Reservoir) and Connections**

1. Final Fuel Filter to Injection Pump Hose
2. Final Fuel Filter Support
3. Final Fuel Filter Header
4. Final Fuel Filter
5. Final Fuel Filter to Supply Pump Tube

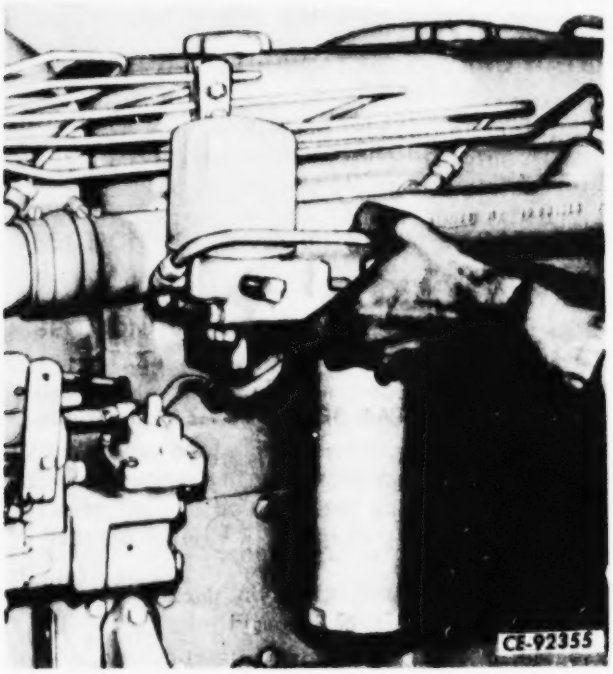



**Fig. 7. Removing Fuel Reservoir and Final Fuel Filter**

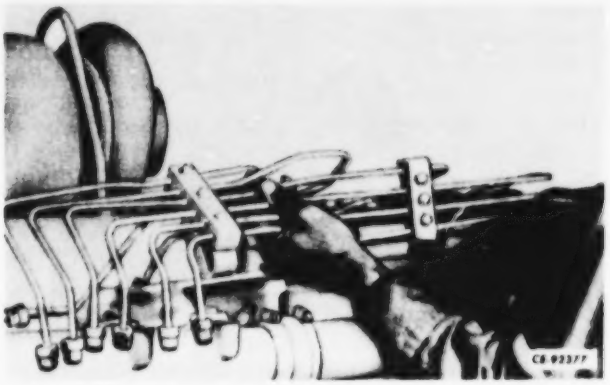


**Fig. 8. Removing Fuel Lines**

7. Loosen the clamps on the hose connecting the front and rear halves of the water manifold. Remove the rear half of the manifold by removing the four cap screws securing it to the rear cylinder head.

**NOTE:** *Disconnect the intercooler water inlet hose from the top of the rear water manifold (if equipped).*

8. Disconnect the water outlet and by-pass hoses at the thermostat housing.

9. Remove the air compressor water inlet hose from the thermostat housing (if equipped).

10. Where necessary, remove the alternator brace cap screw and washer from the thermostat housing.

11. Remove the front water manifold with thermostat housing from the cylinder head.

12. Remove the lubricating oil filter assembly. (Refer to Section 7, "LUBRICATING OIL AND WATER PUMP, OIL FILTER AND COOLERS.")

13. Disconnect the fuel return tubes from the valve housings.

14. Remove the valve housing covers.

15. Disconnect and remove the fuel return tubes. Tape or cap the injection nozzle fittings.

16. Disconnect and remove the fuel supply tubes (Fig. 9).

17. Remove the cap screws and clamps securing the valve housings to the cylinder heads. Lift off the valve housings.

18. Remove the cap screws securing the intermediate valve lever brackets to the cylinder head. Remove the cylinder head stud nuts and flat washers securing the valve lever assembly to the cylinder head. Lift off the valve lever assembly (Fig. 10).

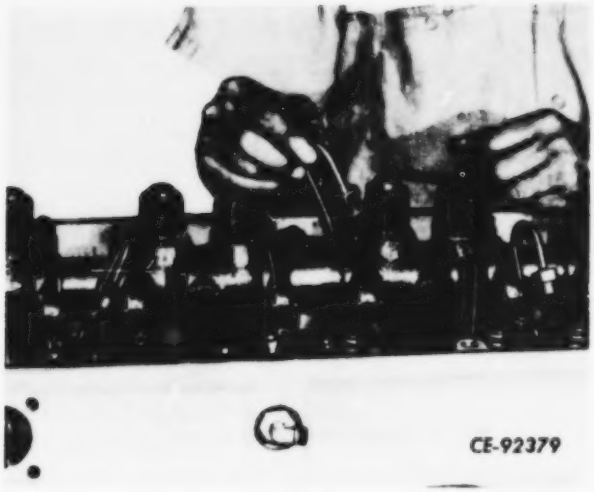



**Fig. 9. Removing Fuel Supply Tubes**

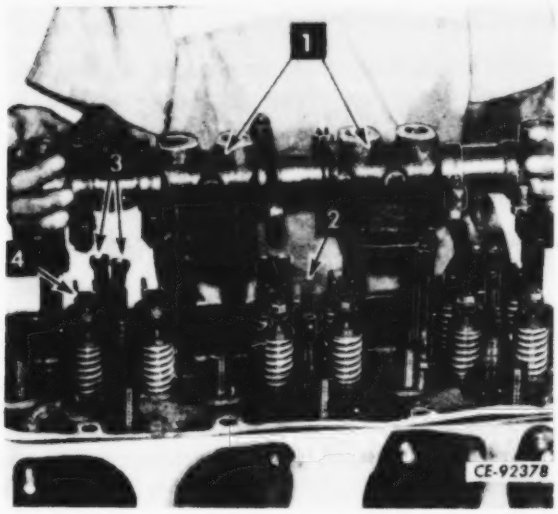



**Fig. 10. Removing Valve Lever Assembly**

1. Intermediate Valve Lever Brackets
2. Injection Nozzle
3. Valve Push Rods
4. Valve Bridge

19. Remove the valve push rods. Remove the remaining cylinder head stud nuts and remove the cylinder head with a hoist (Fig. 11). Remove the cylinder head gasket.

**NOTE:** *The tips of the injection nozzles protrude through the bottom of the cylinder head. To prevent damaging the nozzles, place the cylinder head on blocks or remove the injection nozzles before removing the cylinder heads.*

**NOTE:** *If the crankshaft is to be turned for any reason, clamp the cylinder sleeves in place to prevent them from being pushed out.*

## 6. DISASSEMBLY

### Injection Nozzles (Refer to Fig. 4)

1. Remove the valve lever bridges (42). Remove the injection nozzle hold-down crabs (40) and lift out the injection nozzles (Fig. 12). BE EXTREMELY CAREFUL NOT TO DAMAGE THE NOZZLE TIP. Cap the fuel inlet and return openings and place the injection nozzles in a numbered rack, so that they can be reassembled to their original positions. The rack also helps to protect them from damage in handling.

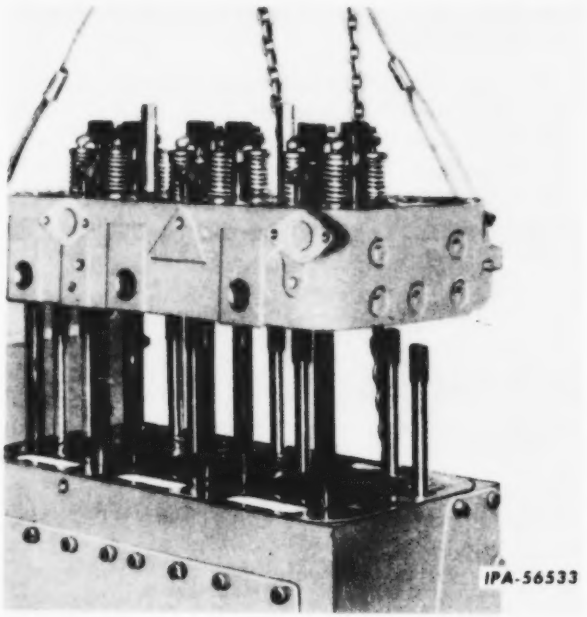



**Fig. 11. Removing Cylinder Head**

2. Remove the valve lever bridges. Compress the valve springs and remove the valve seat keys (Fig. 13). Release the compressor and remove the valve rotator, valve spring and valve seat. Pull the valve out of the valve guide. Remove all of the valves in the same manner. Place each valve in a numbered rack, so that they can be reassembled to their original positions.

### Valve Lever and Shaft Assembly (Refer to Fig. 4)

3. Slide the end brackets (17 and 34) off the shaft (21). Remove the two outer sets of rocker levers. Remove the set screws in the center brackets (25) and slide both brackets with the remaining rocker levers off the shaft.

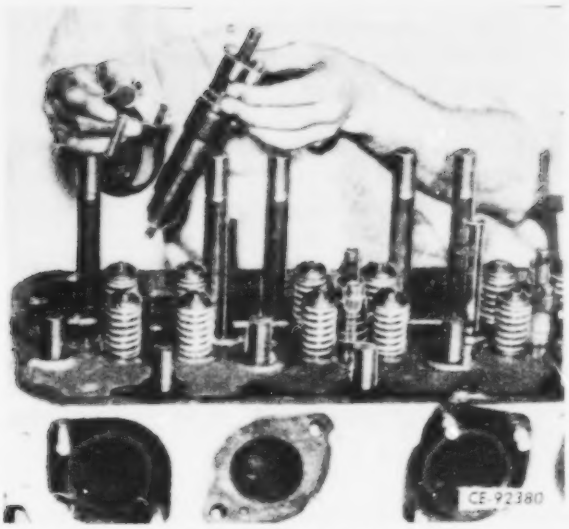



Fig. 12. Removing Injection Nozzle

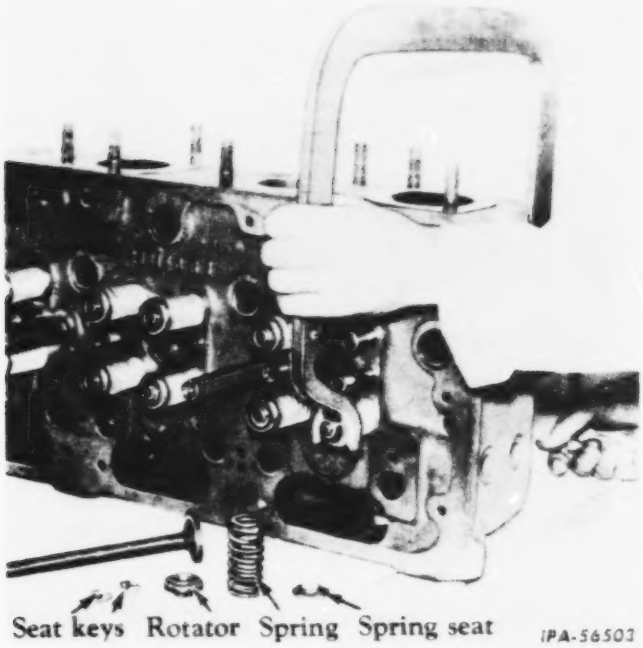



Fig. 13. Removing Exhaust Valves

2. Check the cylinder heads for flatness. Use a feeler gauge and a straightedge long enough to span the length and width of the cylinder head. If more than a 0.08mm (0.003 in.) feeler gauge can be inserted under the straightedge, resurfacing is required. The heads may be resurfaced to a maximum of 0.08mm (0.030 in.) if necessary. After resurfacing the head, the surface must have a smoothness of 0.03mm (0.001 in.) or less with a wave pattern or no more than 76mm (3 in.)

**NOTE:** *The crankcase deck can not be resurfaced.*

Check the cylinder head height before resurfacing. Refer to Section 1, Par. 2, "SPECIFICATIONS" for height. If height is at minimum allowable reconditioning size, further resurfacing cannot be done and it will be necessary to replace the head. If the cylinder head needs to be resurfaced, the protrusion of the valves must be maintained (Fig. 14). Refer to Par. 2, "SPECIFICATIONS" for minimum allowable protrusion.

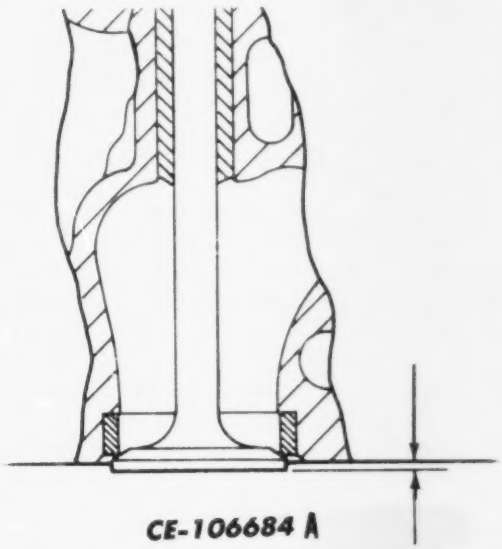



Fig. 14. Valve Protrusion from Cylinder Head

## 7. INSPECTION AND REPAIR

### Cylinder Head

1. Clean the cylinder head and crankcase deck thoroughly. Carbon must be removed from the bottom face of the cylinder head, out of the valve ports and guide bores. Remove the core plugs and flush out the water passages to remove any accumulation of salt, lime or sludge.

### Cylinder Head Studs

Be sure that cylinder head stud holes in the crankcase are thoroughly cleaned out before reinstalling studs. Install the studs to the proper height (Fig. 15). The torque required to turn the studs in to the specified height should be 102-360 N.m (75-265 ft-lbs). If above or below these figures, it is recommended that new studs be installed.

# MANIFOLD, CYLINDER HEADS AND VALVES

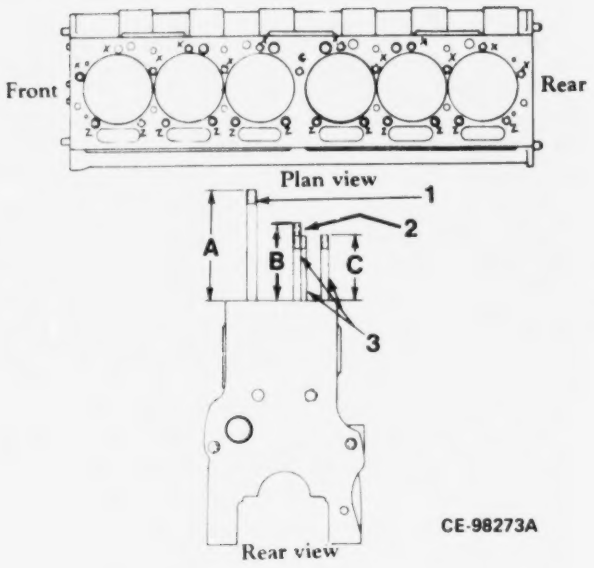



**Fig. 15. Cylinder Head Stud Height**

1. Long Studs – "Z" in Plan View
2. Center Stud – "C" in Plan View
3. Shoft Studs – "X" in Plan View

A, 275 mm (10-13/16 in)
B. Models without Crab – 165 mm (6-1/2 in)
Models with Crab – 198 mm (7-4/5 in)
C. 165 mm (6-1/2 in)

**Cylinder Head Pressure Check**

3. With the injection nozzles installed and the valves removed, pressure check the cylinder heads as follows:

a. Install rubber stoppers and special adapter from the test kit PLT-508 (Fig. 16) or plates (see NOTE) fabricated as shown in Fig. 17, 18 and 19.

**NOTE:** *Fabricate bottom plate from 13 mm (1/2 in) plywood, side plate from 6 mm (1/4 in) steel and a gasket for each plate from 3 mm (1/8 in) rubber.*

b. Fill the cylinder head with hot water. Apply 69-83 kPa (10-12 psi) air pressure and check for leaks.

**NOTE:** *A kit consisting of thicker cylinder head gasket grommet inserts is available for use when the cylinder head or crankcase is eroded in the water passage areas. Remove existing grommets from new cylinder head gaskets and replace with grommets furnished in kit.*

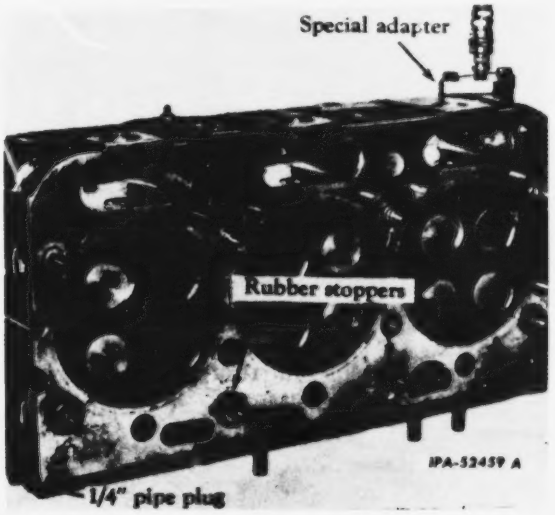



**Fig. 16. Water Test Kit Installed.**

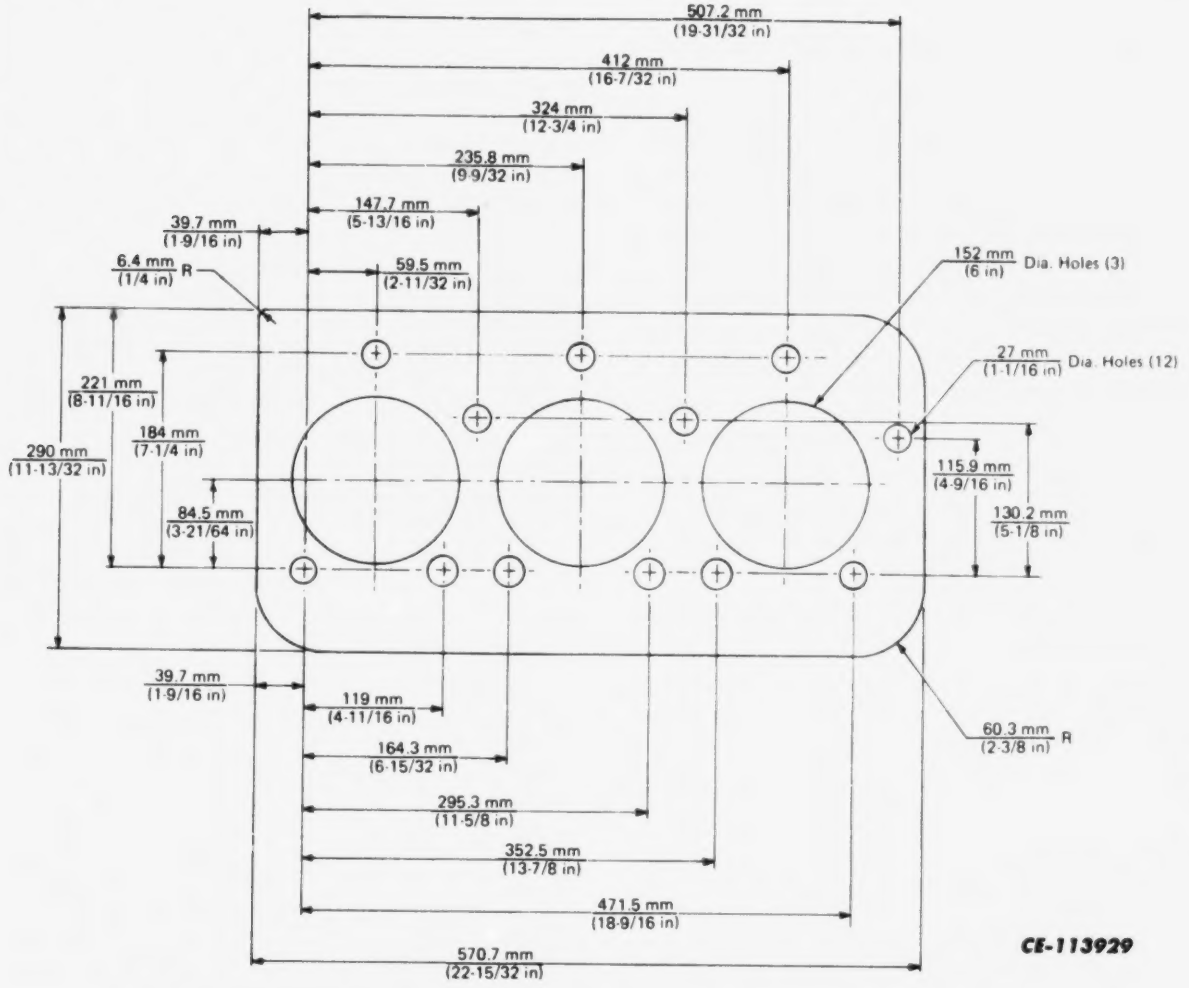



Fig. 17. Cylinder Head Pressure Plate.

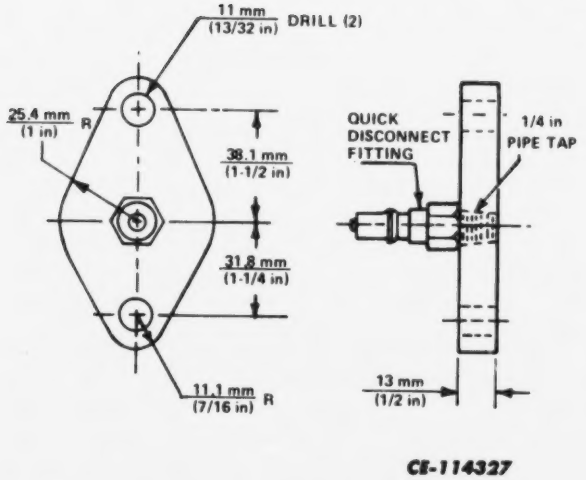

11 mm (13/32 in) DRILL (2)
25.4 mm (1 in) R
38.1 mm (1-1/2 in)
31.8 mm (1-1/4 in)
11.1 mm (7/16 in) R
QUICK DISCONNECT FITTING
1/4 in PIPE TAP
13 mm (1/2 in)
CE-114327

Fig. 18. Side Plate with Quick Disconnect.

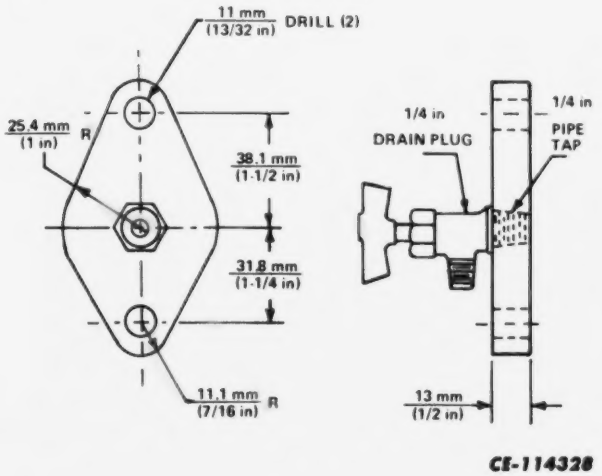



Fig. 19. Side Plate with Drain Plug.

# MANIFOLD, CYLINDER HEADS AND VALVES

**Injection Nozzle Sleeves**

4. If an injection nozzle sleeve is to be replaced proceed as follows:

**NOTE:** *Never remove nozzle sleeve with a chisel and punch as scoring and grooving of machined sealing surfaces will result. Even if these surfaces are dressed with a stone, only the surface burrs are removed; but the grooves remain, leaving potential leaks of coolant into lubricating oil or combustion chamber.*

a. Remove the valve bridge guides to allow for installation of the sleeve puller. (Refer to Par. 8 "VALVE RECONDITIONING.")

b. Install puller No. PLT-507-3. Remove the defective sleeve (Fig. 20).

**NOTE:** *Puller PLT-507-3 is the pre-cup puller used on all IH pre-cup type diesel engines and is used in the same manner.*

c. Clean the sleeve seating surfaces in the cylinder head thoroughly.

d. Place the new sleeve into the sleeve bore in the cylinder head. Tap the sleeve in with a plastic or rawhide hammer until it bottoms.

e. Install sleeve bottoming tool No. PLT-507-4 as shown in Fig. 21. Tighten the hex head nut against the spacer of the tool until the sleeve comes in firm contact with the seat in the cylinder head. The top of the nozzle sleeve can be slightly below the finished surface of the cylinder head but must not protrude above it more than 0.76mm (0.030 in.).

f. Seal the sleeve at the top with expanding roller tool No. PLT-507-1. As the roller is turned, tension is increased against the rollers by the center tapered mandrel. Turn the tool until the mandrel bottoms and no rolling resistance is felt (Fig. 22). At that point, the copper sleeve will be sealed tightly into the cylinder head.

g. Ream the injector seat in the copper sleeve with tool No. PLT-507-2, as shown in Fig. 23. Place the cylinder head on a flat surface and turn the reamer until the pilot on the bottom of the reamer comes in contact with the flat surface.

**NOTE:** *Be extremely careful not to ream the seat beyond this point or the nozzle tip will protrude too far from the face of the cylinder head. (Refer to "SPECIFICATIONS" in Section 1, for the correct protrusion.)*

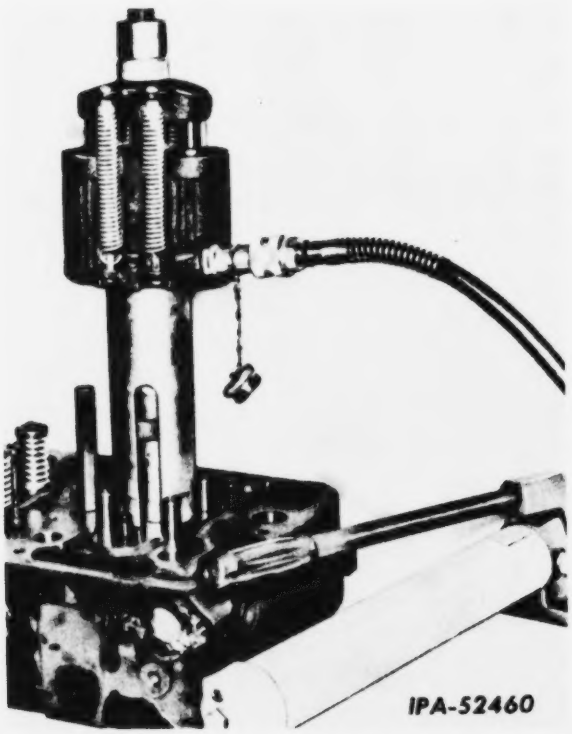



Fig. 20. Removing Injector Sleeve.

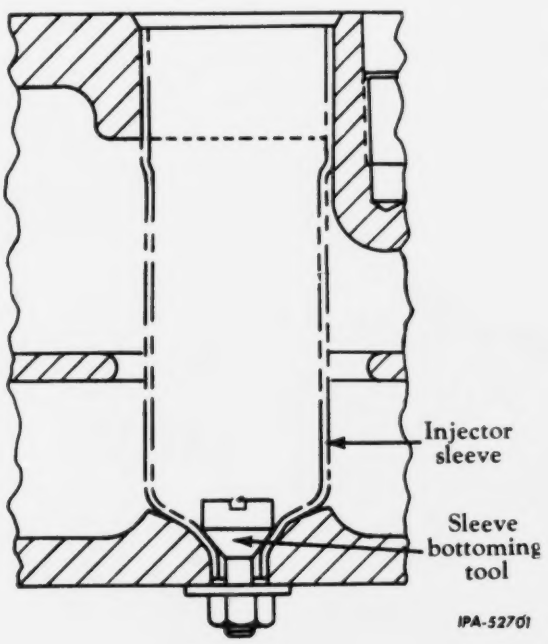



Fig. 21. Injection Nozzle Sleeve Bottoming Tool.

h. Water test the cylinder head as previously outlined in Step 3.

i. Install the valve bridge guides. (Refer to Par. 8, "VALVE RECONDITIONING.")

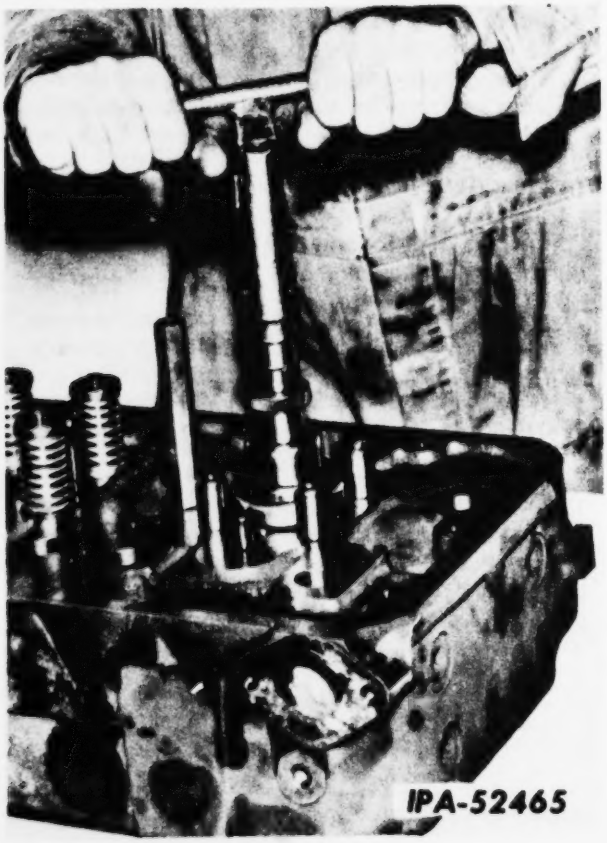



Fig. 22. Sealing Injector Sleeve with Rolling Tool.

Place cylinder head on a flat surface and ream until the pilot on bottom of reamer comes in contact with the flat surface.

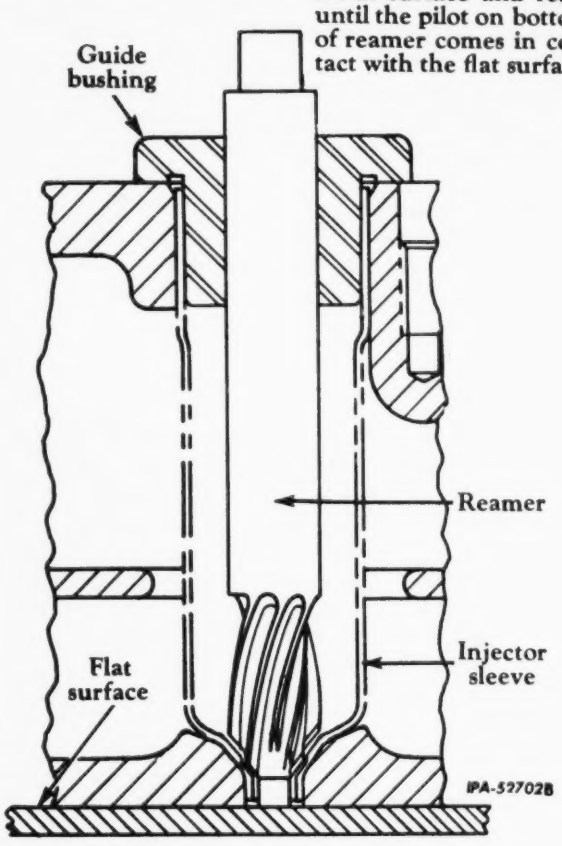



Fig. 23. Injector Seat Reaming Tool.

**Valve Lever and Shaft Assembly**

5. Wash all parts in a cleaning solvent and dry thoroughly with compressed air. Be sure the drilled oil passages in the shaft, intermediate brackets and levers are open. Also clean out the oil passages in the push rods.

6. Check the OD of the valve lever shaft with a micrometer. Check the ID of the valve lever bushings with a telescoping gauge (Fig. 24. The difference between these two readings is the running clearance. If the clearance is greater than the maximum allowable shown in "SPECIFICATIONS" in Section 1, replace the worn parts.

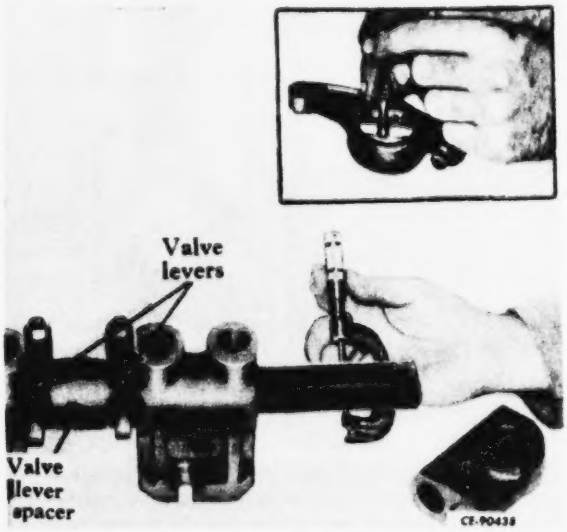



Fig. 24. Checking Valve Lever Bushings and Shaft for Wear.

# MANIFOLD, CYLINDER HEADS AND VALVES

7. When replacing the lever bushings, be certain that the oil hole in the bushing aligns with the oil hole in the lever. Bore or hone the bushings to the dimensions shown in "SPECIFICATIONS" in Section 1.

8. Inspect valve stem contact pad surface of the valve levers and replace if wear is severe.

**Injection Nozzle Lines**

9. Blow compressed air through the injection nozzle supply and return lines to be sure they are clean.

**Cylinder Sleeve Protrusion**

Whenever the cylinder heads are removed, new head gaskets must be used. The pressure contact surface of the integral gasket rings are grooved to provide a better seal. This surface flattens out when the heads are torqued and may destroy the sealing effect if reused. Check cylinder sleeve flange protrusion as described in the following steps. After the sleeve flange protrusion has been determined adjust the cylinder to obtain the correct total height (shims) required for proper combustion sealing (see NOTE).

**NOTE:** *When shimming of sleeve is necessary to obtain proper protrusion, it is desirous to use no more than two shims and only one if possible per sleeve. If more shims are used, they may set or extrude from their position. If necessary, resurface the counterbore and use a thicker shim rather than using more shims of a smaller size. The total thickness of all shims used per sleeve can not exceed 1.63 mm (0.064 inch).*

Follow the instructions that pertain to the existing condition of your engine.

**NOTE:** *Each cylinder may be adjusted independently. It is acceptable to use shims one thickness in one cylinder, and shims of another thickness in a different cylinder to arrive at the correct total height for proper combustion sealing.*

10. Install the cylinder sleeve without the "O" rings, into the crankcase. Clamp the sleeve down by placing a sleeve holding adapter (Fig. 26) over three studs (Fig. 25 shows which studs to use). Make sleeve holding adapters locally. Place three pipes with a maximum ID of 25mm (1 in.) over the same

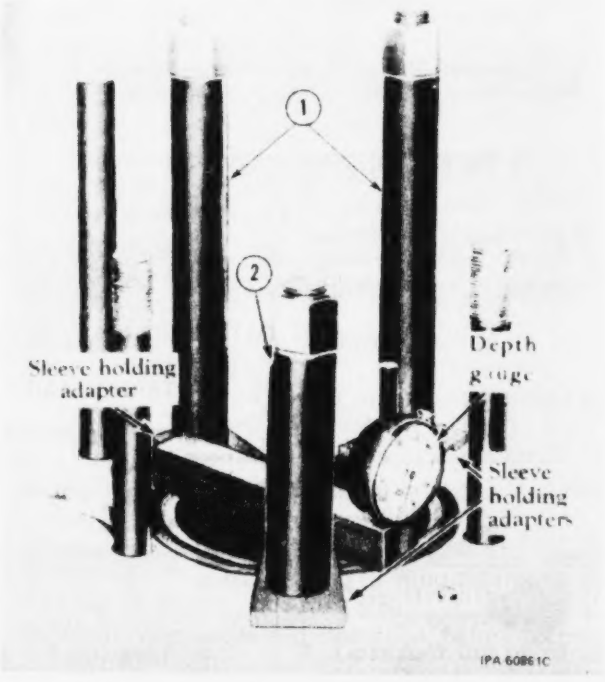



**Fig. 25. Cylinder Sleeve Clamping**

1. Pipe Over Long Studs 215mm (8-1/2 in.)
2. Pipe Over Short Studs 115mm (4-1/2 in.)

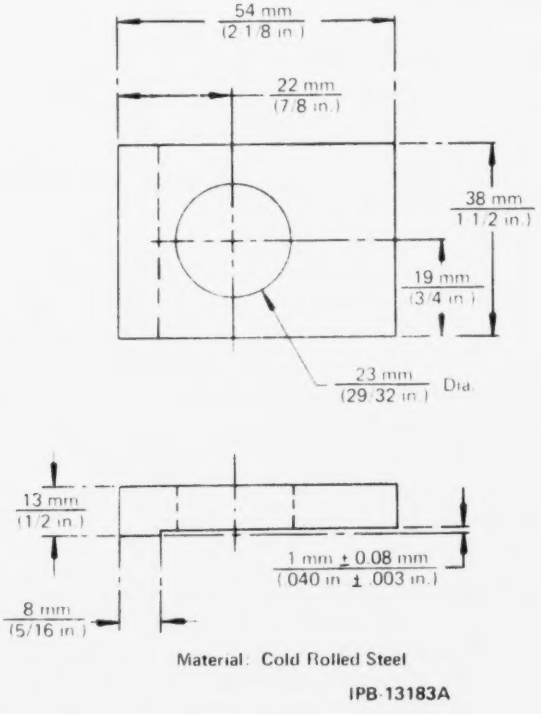

54 mm (2 1/8 in.)
22 mm (7/8 in.)
38 mm 1 1/2 in.)
19 mm (3/4 in.)
23 mm (29/32 in.) Dia.
13 mm (1/2 in.)
1 mm ± 0.08 mm (.040 in ± .003 in.)
8 mm (5/16 in.)
Material: Cold Rolled Steel
IPB-13183A

**Fig. 26. Cylinder Sleeve Holding Adapter**

three studs. For the long studs use 215mm (8-1/2 in.) long pipes and 115mm (4-1/2 in.) pipe for the short end. All pipes must be square and flat on both ends. Place a regular cylinder head washer on top of the pipes and install the regular cylinder head nuts. Torque the nuts to 155 N.m (150 ft-lbs) in three stages at 68 N.m (50 ft-lbs), 135 N.m (100 ft-lbs) and 155 N.m (150 ft-lbs)

11. Use a dial indicator to determine the protruded height as follows (refer to Fig. 27):

a. Place the dial indicator, with block, across the cylinder sleeve. Top of sleeve must be clean and free of carbon.

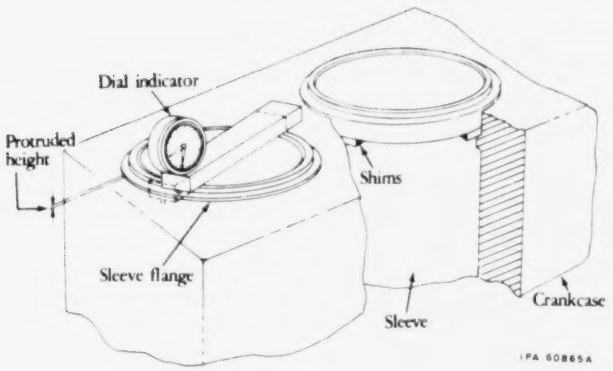



**Fig. 27. Cross Section of Crankcase**

b. With the indicator pointer on the sleeve flange, set the indicator at zero. Move the indicator block until the pointer drops to the crankcase deck and take the reading.

c. If the sleeve flange is below the crankcase deck, rest the indicator pointer on the crankcase deck and set the indicator at zero. Move the indicator block until the pointer drops to the sleeve flange and take the reading.

d. This check must be made at four points around the cylinder and the average reading used to determine which shim is needed.

**NOTE:** *If a variation of 0.05mm (0.002 in.) exists between these readings, the sleeve must be removed and the crankcase counterbore depth checked at several points around the counterbore using depth gauge, 1 020 560 R91, Fig. 28). Maximum variation between points of measurement cannot exceed 0.05mm (0.002 in.). Mark each sleeve before removing so that it can be reinstalled in the same bore and in the same position as it was while making the protrusion check. If the engine has been run with a blown gasket ring or evidence of water leakage is present, check all sleeve counterbores to determine if resurfacing is necessary prior to installing shims. Shims are available in the following thickness: .002, .004, .010, .020 and .032 inch. This must be done even if the sleeve protrusion checked out to be within 0.05 mm (0.002 inch) specification. Make sure that the sleeve counterbore and the sleeve flange are clean and free of foreign material.*

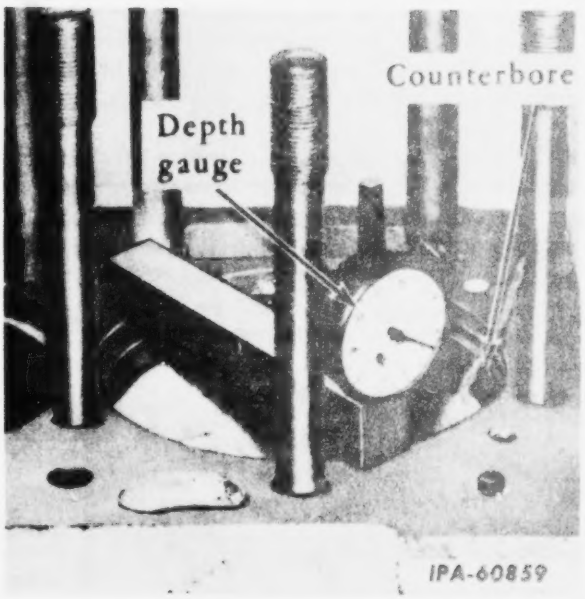



**Fig. 28. Checking Crankcase Counterbore Depth.**

**Crankcase Counterbore Refacing**

12. If sleeve flange protrusion was found to be more than 0.08mm (0.003 in.) below the crankcase deck, the crankcase counterbore must be refaced as described under "REFACING CYLINDER SLEEVE COUNTERBORE IN CRANKCASE" in Section 3. After counterboring, place the necessary shims (see NOTE) under the sleeve flange to raise it up to 0.05-0.10mm (0.002-0.004 in.) above the crankcase deck. Install the sleeve.

**NOTE:** *When shimming of sleeve is necessary to obtain proper protrusion, it is desirous to use no more than two shims and only one if possible per sleeve. If more shims are used, they may set or extrude from their position. If necessary, resurface the counterbore and use a thicker shim rather than using more shims of a smaller size. The total thickness of all shims used per sleeve cannot exceed 1.63 mm (0.064 in).*

## 8. VALVE RECONDITIONING

### General

Carbon deposits on the valves and valve seats are normal and cannot be avoided completely (Fig. 29). Such deposits, however, are detrimental to engine efficiency and valve assembly life as the amount of carbon in the engine increases.

Whenever a cylinder head is removed for service, all carbon must be removed from the surfaces of the parts affected. Valves and valve seats must be examined for pitting, burning, warping and other defects.

**Fig. 29. Carbon Corrosion and Wear are Inevitable Products of Normal Engine Operation.**

The formation of carbon cannot be avoided, however, it can be held to a minimum by use of good grade fuels and accurate engine timing.

Warpage, burning and pitting of the valves is more likely to occur in the exhaust valves because they are exposed to the high temperature flow of exhaust gases. Such defects are generally caused by valves failing to seat tightly and evenly; this permits exhaust blow-by. This, in turn, can generally be traced to hard particles of carbon being present on the valve faces or seats. It may, however, be due to weak springs, insufficient valve clearance, or warpage and misalignment of the valve stem or guide.

Warpage chiefly occurs on the valve stem due to its exposure to heat. Out-of-round wear occurs when the seat has been pounded by a valve head which is not in line with its stem or guide.

Misalignment is a result of wear, warpage, and distortion. Wear, when accentuated by insufficient lubrication, will eventually create sloppy clearances with resulting misalignment.

Warpage of the valves can result from the engine overheating due to a blocked, dirty or insufficiently filled cooling system.

More frequently, however, warpage of a valve stem or a guide is due to uneven temperatures being applied along its length. The lower part of the guide and stem is near the combustion heat and the upper portions are closer to the cylinder head water passages. Valve materials are carefully chosen to withstand such varying temperatures. However, an engine that is allowed to operate continually in an overheated condition is definitely open to valve stem and guide distortion and warpage. Distortion can also be caused by failure to tighten cylinder head bolts to the specified torque in the sequence recommended. Valve clearances are also affected in this manner.

Thus, any abnormal wear, warpage or distortion, affecting a valve guide, will destroy its function as an accurate bearing to maintain the valve head concentric with its seat. This will prevent leak-proof seating.

Oil and air are sucked past worn intake valves, stems and guides into the combustion chamber. This causes excessive oil consumption, which forms excessive carbon and dilutes fuel.

### Inspection Prior to Valve Reconditioning

Before disassembly of the engine for removal of the cylinder head, examine the engine for signs which may indicate the reason for the need of valve reconditioning. Dry and rusted valve springs are an indication that the oil passages to the valve levers may

be blocked. This will cause wear on the valves and guides and result in improper valve action. A defective gasket under the valve housing cover will permit the entrance of dirt; this will cause undue wear on valve stems and guides, and damage to valve springs. Finding the cause of a valve failure will aid in reconditioning it.

**Valves**

1. Remove all carbon from the valve face, head and stem. A wire brush or buffing wheel (Fig. 30) can be used to a good purpose for this operation. Valve stems should be lightly polished with an extremely fine abrasive cloth, enough to remove the carbon deposits only.

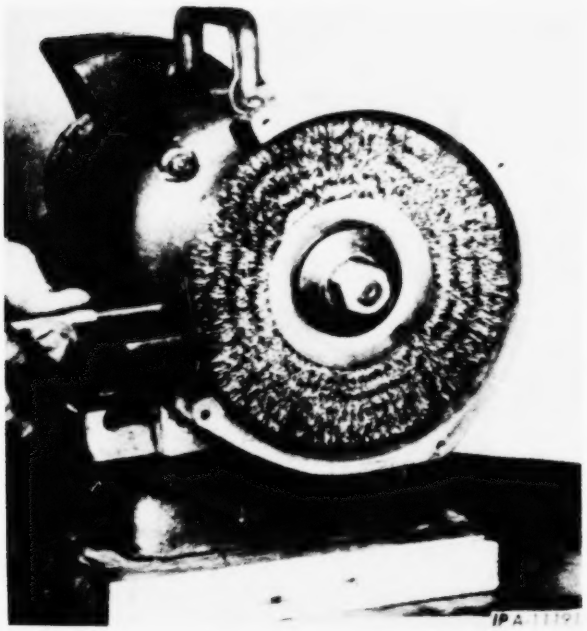


**Fig. 30. Cleaning Carbon from the Valve.**

2. Place a straightedge across the valve head and check for "dishing" (Fig. 31). Any valves that are dished must be discarded. A narrow margin is the common cause of dishing, therefore scrap and replace any valve that cannot be satisfactorily refaced (Fig. 37) with the specified margin (50 percent of a new valve).

3. Severely burned valves must be discarded, since the metal behind the burn has probably lost its original properties. Valves which show indications of "necking" (Fig. 32) must also be discarded. Necking is evidenced by a reduced diameter of the valve stem above the port end of the guide and is the result of hot corrosion. Necked valves are susceptible to breakage, a most expensive type of failure, since the engine may be badly damaged when a valve head breaks off.

**Fig. 31. Dished Valve Head.**

**Fig. 32. Necked Valve Stem.**

**Fig. 33. Scuffed Valve Stem.**

4. Discard any valves that have badly scuffed stems (Fig. 33). Rough stems usually cause rapid guide wear. However, where there are only slight indications of scuffing at the extremities of the guide contact area and where there is no appreciable reduction in the stem diameter, such valves will continue to give satisfactory service.

5. Inspect for worn keeper grooves and damaged valve tips. These are undesirable conditions and are sufficient causes for discarding a valve. Worn grooves allow cocking of the spring retainer which tends to tip the valve in the guide, increasing guide wear and in extreme cases causing leakage across the valve face. Similar results can be expected from the use of valves having badly damaged tips. Refacing machines usually have an attachment for reconditioning the valve tip, however, where the tip is badly damaged, grinding may remove all of the case hardened metal on the tip. For this reason, valves with deep notches or grooves in the tip must not be used.

6. Measure the OD of the valve stems (Fig. 34) at various locations along the guide bearing area, and at each location take several readings around the circumference. If the readings are below the minimum permissible stem diameter dimension shown in "SPECIFICATIONS" in Section 1 discard the valve.

7. Check valve stem straightness (Fig. 35). If the stem "runout" is more than 0.03mm (0.001 in.), discard the valve.

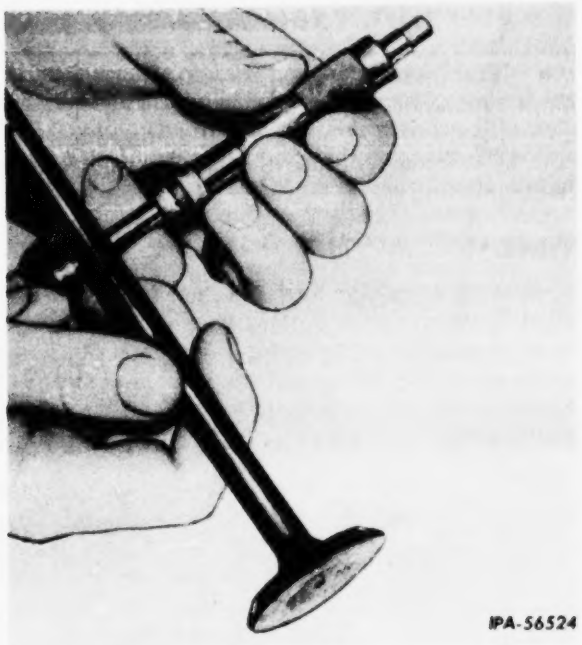



**Fig. 34. Checking Valve Stem OD**

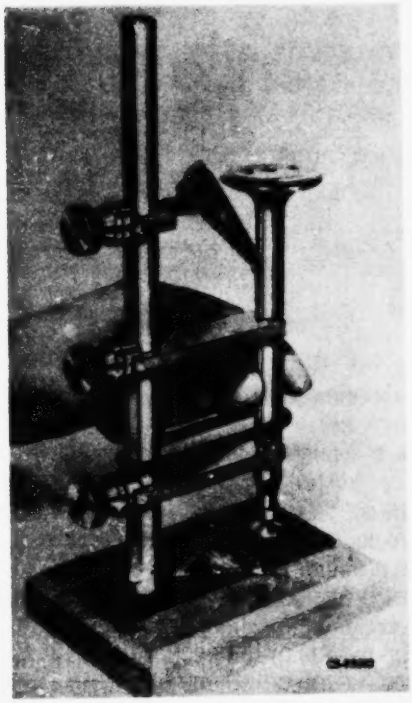


**Fig. 35. Checking Valve Stem Straightness and Face Runout**

**Valve Face Grinding**

8. Set the valve refacing machine to grind the correct valve face angle (Fig. 36). (Refer to "SPECIFICATIONS" in Section 1.) Dress the grinding stone.

9. Insert a valve in the chuck. When it is previously centered, take a light cut across its face. This is a check to determine whether or not the valve can be reconditioned to service standards with a correct amount of margin maintained. Warpages that may not be apparent in the visual inspection will be clearly definable (Fig. 37).

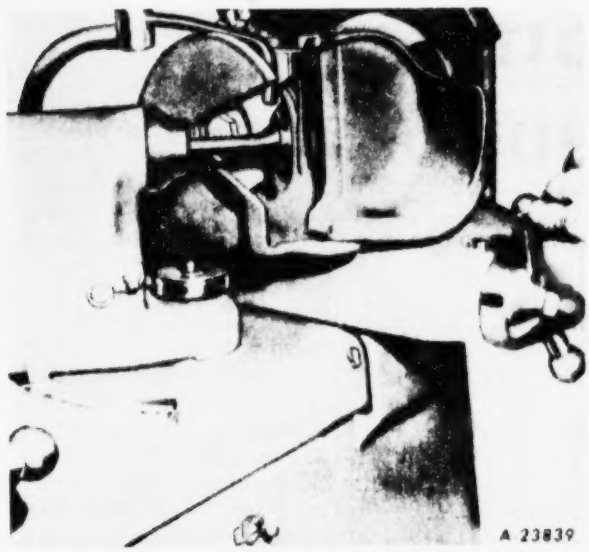



**Fig. 36. Locating the Valve and Grinding Stone to the Specified Angle**

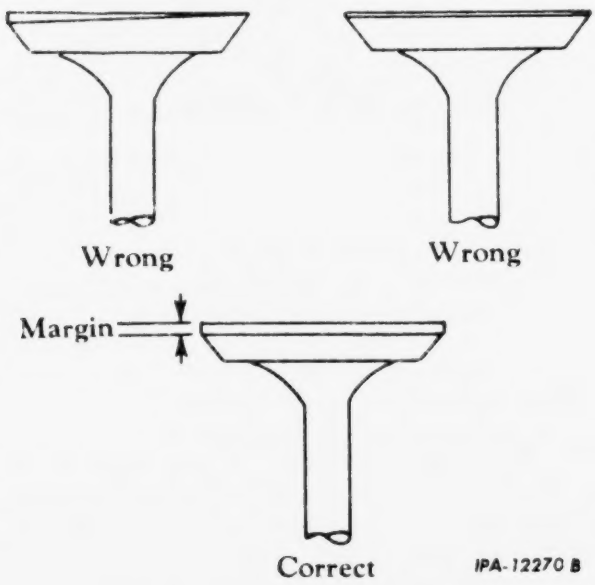



**Fig. 37. Maintaining Proper Margin.**

10. Avoid taking heavy grinding cuts as this heats the valve head excessively, produces an unsatisfactory valve face, and necessitates dressing the grinding wheel frequently. Repeated light grinding cuts are preferred until a true face of even width is obtained around the valve. Avoid passing the stone beyond the face of the valve, as this will cause ridging and grooving of the stone surface and make dressing of the stone necessary. Reject all valves with distorted heads which produce an uneven face, and valves which grind down to a thin edge (Fig. 37).

> **NOTE:** *The maximum amount of material which can be removed from either the valve seat or the valve face is 0.25mm (0.010 in.) for exhaust and 0.30mm (0.012 in.) for intake. However, if both the valve face and the seat must be refaced, the combined total material removed from both must not exceed 0.38mm (0.015 in.). Only the minimum amount needed to make a good valve seat contact should be removed. If necessary to remove more than the maximums stated above, the valves and/or valve seat inserts must be replaced.*

11. At times, unusually large amounts of heat scale may be found on exhaust valves; this is rough on the grinding stone. Frequent redressing of the stone will be necessary in order to maintain a smooth, even surface, and a uniform set of valve face angles.

12. After refacing each valve, inspect the end of the stem. If wear is noticeable, but not too severe, reface the end of the stem with the attachment

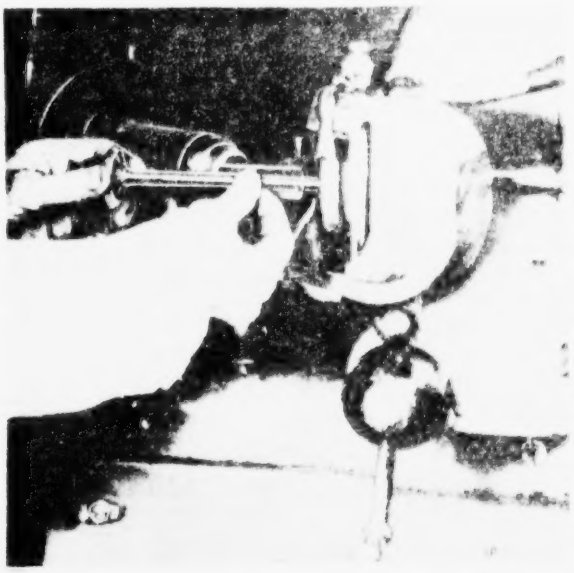


**Fig. 38. Refacing the Valve Stem End.**

# MANIFOLD, CYLINDER HEADS AND VALVES

usually provided with the valve grinding equipment (Fig. 38). Grind sufficiently to true-up the end of the stem.

13. Check valve face runout (Fig. 35) and head margin (Fig. 37) after refacing. The maximum face runout in reference to the valve stem must be less than 0.05mm (0.002 in.) total variation in the dial indicator reading. The head margin must be at least one-half that of a new valve of the same type. New valves must also be checked for straight stems and face runout as they may have been damaged in shipment or by handling.

### Valve Guides

14. Use a 11 mm (7/16 in) nylon bristle brush, solvent and power drill to remove any residue in the guide bore. The guide then must be washed down with a strong soap solution. As an option, a 10 mm (3/8 in) spiral brush can be used for cleaning. Examine the bore for signs of burning, blistering, cracking or excessive wear.

**NOTE:** *Guides require very careful cleaning. Carbon left in the guide will deflect the pilot and result in inaccurate reconditioning of the valve seat.*

15. Measure the ID of the valve guide with a small hole gauge at several points around its circumference and along its length (Fig. 39). If the readings are above the maximum permissible dimensions shown in "SPECIFICATIONS" in Section 1 replace the guide.

16. Press out worn guides from the underside of the cylinder head, from the valve port up through the top. Use a mandrel slightly smaller than the guide in order to prevent jamming it in the guideway.

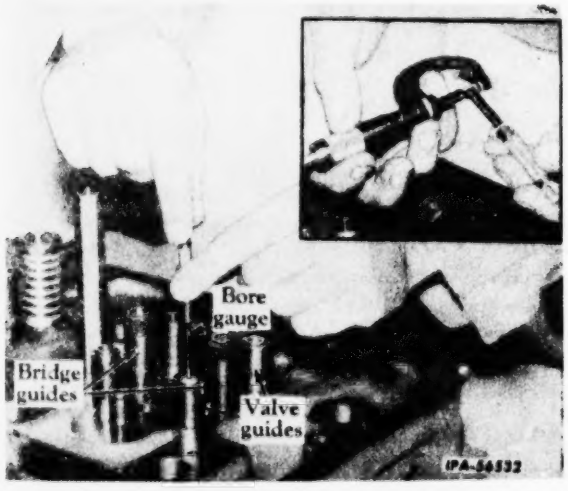



**Fig. 39. Checking Guide ID.**

17. Using a mandrel, press the new valve guides in from the top of the cylinder head. (See NOTE.) The guides must extend the specified distance above the top surface of the cylinder head. (Refer to "SPECIFICATIONS" in Section 1 for the distance involved (Fig. 40).

**NOTE:** *The valve guides have a 30° chamfer at the top of the guide, and an internal thread in the bottom portion. The guides must be installed with the threaded end downward.*

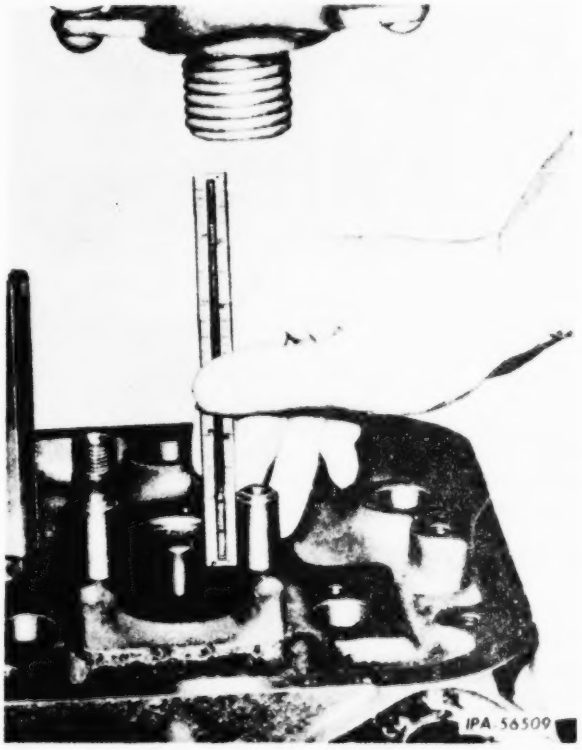



**Fig. 40. Measuring Position of Valve Guides.**

18. All guides furnished as service parts are reamed to size. However, as they are a press fit, it is necessary to ream them after installation to remove any possible burrs or slight distortion caused by the pressing operation. (Refer to "SPECIFICATIONS" in Section 1 for the ID of new guides.)

### Valve Bridge and Guides

19. Measure the ID of the bridge guides in the same manner as the valve guides (Fig. 39). Measure the OD of the valve bridge stems across the greater diameter (not the flat sides) with a micrometer. If the difference between these two readings is greater

than the maximum allowable stem clearance given in "SPECIFICATIONS" in Section 1, replace bridge stems and guides. (Fig. 41).

20. All replacement guides now have an outside diameter of 17.488-17.501mm (0.6885-0.6890 in.) in the area that is pressed into the cylinder head. After the old guide is removed, (Fig. 41) measure the diameter of the guide hole in the head to see if it is 17.450-17.463mm (0.6870-0.6875 in.). If not, it must be enlarged to this dimension by reaming to a depth of 18.29mm (0.720 in.) and restoring the original chamfer to the edge of the hole. The new guide will then have a tight press fit of 0.03-0.05mm (0.001-0.002 in.). It is recommended that the new guides be installed with a press and a suitable sleeve driver.

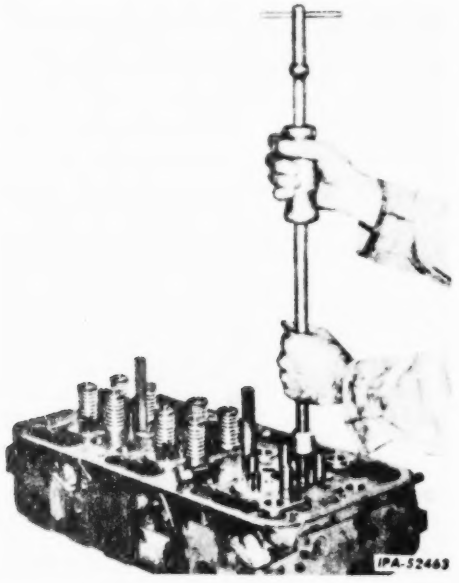



**Fig. 41. Removing Valve Bridge Guides**

21. Following is a suggested method for checking wear on the valve lever bridge. Other methods can be used. Using a block of hard wood with one side finished, drill a hole large enough to allow the stem of the bridge to fit through (Fig. 42). If a surface plate is available, use that with suitable supports, instead of the block of hard wood.

22. Install the indicator into the indicator block and place the block on the hard finished surface. Place the indicator point on the bridge at the edge of the wear groove. Set the indicator at zero and move the indicator block until the indicator point drops into the wear groove (Fig.42). Take a reading. If the reading exceeds the wear limit given in "SPECIFICATIONS" in Section 1, replace the valve bridge.

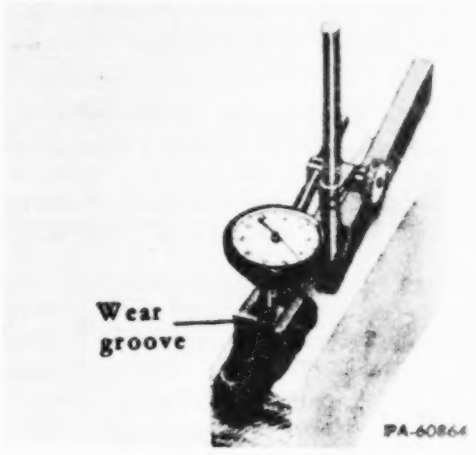



**Fig. 42. Checking Valve Bridge for Wear**

### Valve Seats and Seat Inserts

23. Inspect the intake and exhaust valve faces and seat inserts for cracks and burned condition. Also check the valve seat inserts for looseness.

24. Remove defective valve seat inserts with an insert puller (Fig. 43).

25. If new oversize valve seat inserts are to be installed, ream the insert counterbore in the cylinder head to the dimension shown in the chart to obtain the correct fit.

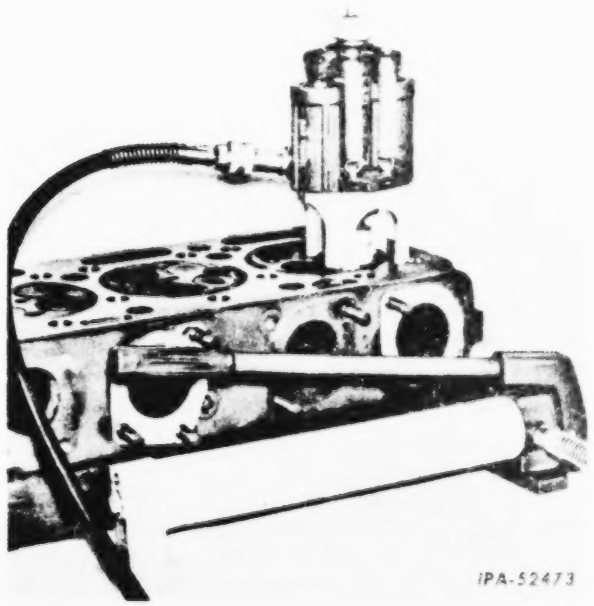



**Fig. 43. Removing Exhaust Valve Seat Insert.**

# MANIFOLD, CYLINDER HEADS AND VALVES

| INTAKE AND EXHAUST VALVE SEAT INSERT CHART | |
|---|---|
| **APPLICATION** | **COUNTERBORE DIAMETER** |
| 0.002 in. Oversize | 1.7800-1.7810 in. |
| 0.015 in. Oversize | 1.7930-1.7940 in. |

26. To assure maximum valve and insert life, it is essential that the valve insert ring be installed to obtain maximum contact with the bottom and sides of the ring counterbore. Proper heat dissipation through the valve insert ring can only be accomplished by the valve insert ring being a good tight fit in the cylinder head with the bottom of the insert ring squarely seated on the bottom of the counterbore as shown in Fig. 44.

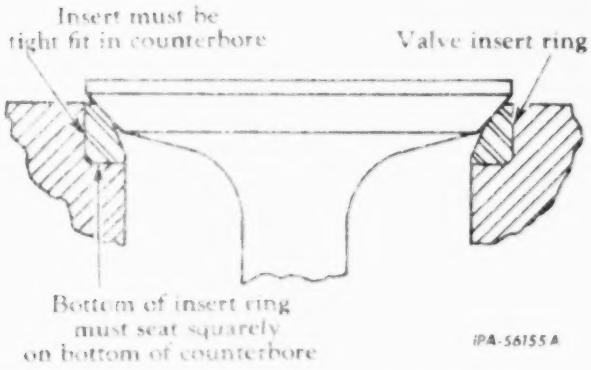

Insert must be tight fit in counterbore
Valve insert ring
Bottom of insert ring must seat squarely on bottom of counterbore
IPA-56155A

Fig. 44. Insert Ring Properly Installed.

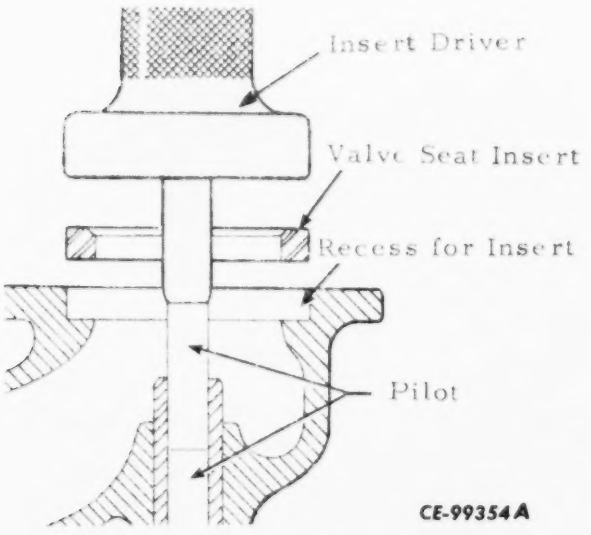



Fig. 45. Installing Insert.

Valve seat inserts which are not fitted tight, work loose, permitting carbon formations to collect on the outer surface of the insert, thus insulating the exhaust heat within the insert, preventing proper heat dissipation through the cylinder head.

27. Install valve seat inserts as follows:

a. Chill the inserts and driver thoroughly in dry ice for at least one-half hour before installing.

b. Properly align insert to avoid cocking.

c. Using an arbor press and driver, press the insert into the cylinder head (Fig. 45). An evenly applied 2225 N (500 lbs) load is required for proper installation and is to be sustained for a five second period to guarantee proper seating.

**NOTE:** *DO NOT install inserts by hammering or striking insert driver.*

**NOTE:** *After installing the insert, do not peen the head metal over the edge of the insert.*

### Refacing Valve Seats and Seat Inserts

Remove all carbon, scale, and oil before attempting to reface the valve seats. The grinding stone, when placed against an oily seat, will become fouled and uneven grinding will occur.

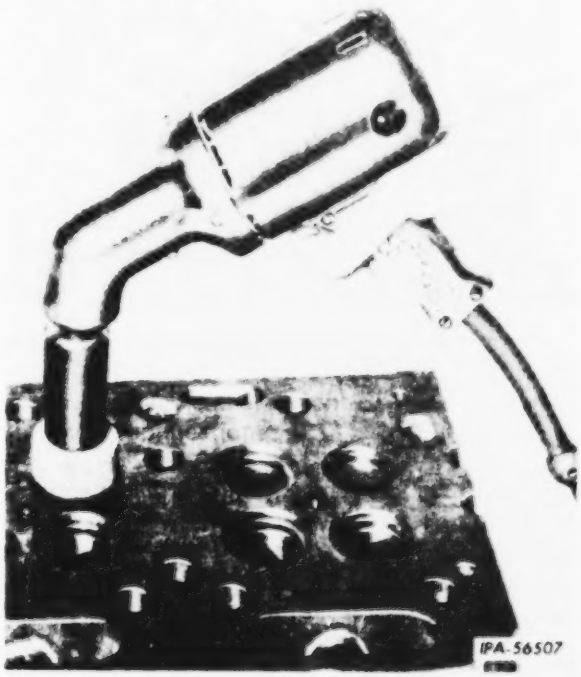



**Fig. 46. Grinding the Valve Seat by Using One of the Many Grinding Tools of Standard Manufacture**

28. Use a clean, oiled rag to lubricate the pilot shank lightly. Before installing the pilot, be certain that the valve guides are perfectly clean. This is important; otherwise, an eccentric seat will be cut.

29. Depress the stone to the correct angle and install a pilot of the correct size to the valve guide bore. Refer to "SPECIFICATIONS" in Section 1 and Fig. 48 for seat angle and guide ID.

30. Lower the grinder head over the pilot shank until the stone just clears the valve seat. Turn on the power and very gently allow the stone to contact the valve seat (Fig. 46). Very little pressure other than the normal weight of the stone must be used. Sudden, hard pressures can cause cocking of the pilot in the guide and result in eccentric grinding. Frequently raise the stone from the valve seat in order to prevent overheating and to clear away grinding dust. Grind the seat sufficiently to provide an even, smooth surface.

**NOTE:** *The maximum amount of material which can be removed from the valve seat is 0.25mm (0.010 in.) for exhaust and 0.30mm (0.012 in.) for intake. However, if both the valve face and the seat must be refaced, the combined total mater :: removed from both must not exceed 0.38 mm (0.015 inch). Only the minimum amount needed to make a good valve seat contact should be removed. If necessary to remove more than the maximums stated above, the valves and/or valve seat inserts must be replaced.*

31. Check the seat concentricity with the valve guide by using a dial indicator mounted on the pilot. Run the indicator around the seat surfaces, thereby testing for concentricity. Runout must not exceed a total of 0.05mm (0.002 in.)

32. The finish left by the regular type grinding stone is usually satisfactory for practical purposes. Lapping valves into their seats is unnecessary if precision equipment is used and extreme care taken. A simple and dependable method of testing refaced valves and seats for roundness and concentricity employs Prussian blue, a concentrated pigment sold in tubes. Spread an extremely thin film of this blue on the valve face and insert the valve into its guide.

With pressure on the exact center of the valve head, make a quarter turn rotation in the seat. Remove the valve and inspect the impression made upon the seat by the transfer of blueing, and upon the valve face by the removal of blueing. Check several times to be sure that no error was made.

33. After grinding the seats, it may be found that the seats are considerably wider than the width recommended in the table under "VALVE ROTATORS."

Valve seats that are too wide (Fig. 47) may be narrowed by grinding down the top edge of the seat with a stone mounted on the grinder head. The stone must be a smaller angle than the valve seat (15 degrees preferably) (Fig. 48).

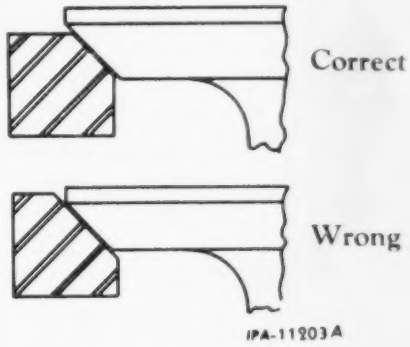



**Fig. 47. Valve Seat Width Must Conform to Specifications and Center of the Valve Face.**

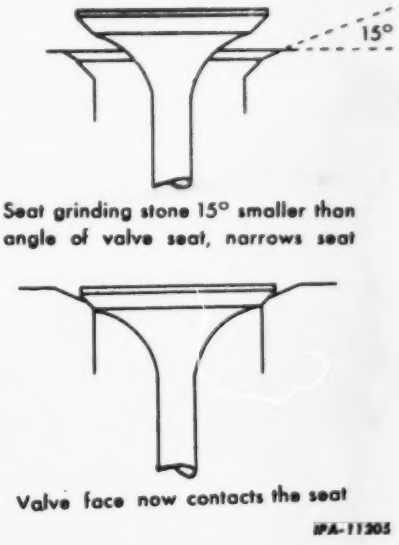



**Fig. 48. Narrowing Valve Seat Width.**

### Valve Springs

34. Check the spring load in the valve open and closed positions with spring tester No. PLT-100 (Fig. 49). Spring load and length is shown in "SPECIFICATIONS" in Section 1.

# MANIFOLD, CYLINDER HEADS AND VALVES

**Fig. 49. Checking Valve Spring Tension.**

35. Springs must be free of corrosion, pitting, scratches and notches. The spring ends must be flat and square to prevent lateral loads on the valve stems. Check both ends of the springs on a flat surface as shown in Fig. 50. Any out-of-square springs must be discarded.

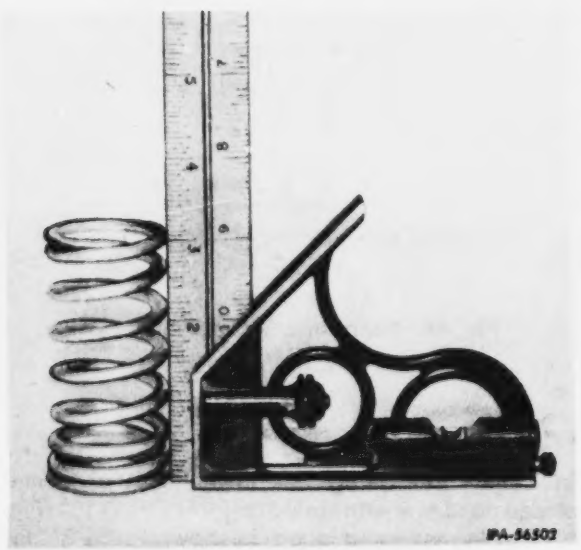



**Fig. 50. Checking Valve Spring Alignment.**

**Valve Rotators**

36. The rotator can be identified by a snap ring on the bottom of the rotator. The rotator can be disassembled for cleaning and inspection by removing the snap ring. Individual parts are not furnished separately and a new rotator assembly must be installed if any part is worn or damaged.

> NOTE: *When reassembling the rotator, the belleville washer must be installed with the concave side toward the snap ring (pitch of washer down against spring).*

Check the valve rotators for operation. A valve rotator in the free state (not assembled in the engine) may rotate in either direction, or may not rotate at all and still be satisfactory for use.

To properly test a valve rotator for rotation, a valve spring load must be applied to the rotator. This can be done in a spring tester or assembled in an engine.

When using a spring tester, place the valve spring, with the rotator, in a tester (Fig. 51). Place a bearing ball between the rotor cap and the ram of the spring tester. By compressing the valve spring, the valve rotator can be observed as it turns.

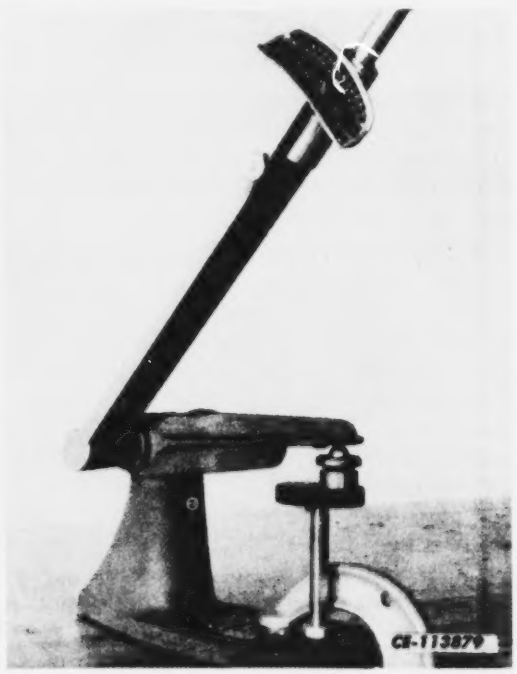



**Fig. 51. Testing Valve Rotator.**

**Valve Spring Retainer Locks**

37. Clean parts thoroughly in solvent. Check the ribs in the inside of the locks to be sure that none are worn enough to cause looseness. The locks must fit snugly into the valve stem groove. Check the locks for wear on the outside surface (see NOTE) which might allow the valve spring retainer to slide over the lock. Replace if in doubt.

NOTE: *Wear on the outside surface of the locks can be caused by overspeeding the engine.*

**SPECIFICATIONS OF VALVE ANGLES AND DIMENSIONS (Refer to Fig. 52)**

| Symbol | Intake and Exhaust Valve |
|---|---|
| A | 45° (Exhaust) — 60° (Intake) |
| B | 43.18-43.43mm (1.700-1.710 in.) |
| C | 11.05-11.07mm (0.4350-0.4360 in.) |
| D | 187.07mm (7.365 in.) |
| E | 38mm (1-1/2 in.) |
| F | 41.83mm (1.647 in.) |
| G | 1.70mm (0.067 in.) |
| H | 66.14mm (2.604 in.) |
| I | 87.38mm (3.440 in.) |
| J | 11.10-11.15mm (0.437-0.439 in.) |
| K | 17.488-17.501mm (0.6885-0.6790 in.) |
| L | 29mm (1-1/8 in.) |
| M | 1.91-1.98mm (0.075-0.078 in.) |
| N | 13.28-13.34mm (0.523-0.525 in.) |
| O | 45.16-45.19mm (1.778-1.779 in.) |

**KEY TO VALVE CHART (Refer to Fig. 52)**

A. Valve Face Angle
B. Valve Head Diameter
C. Valve Stem Diameter
D. Valve Length
E. Valve Port Inside Diameter
F. Valve Seat Outside Diameter
G. Valve Seat Width
H. Distance from the Valve Seat or Insert Face to the Head End of the Valve Guide
I. Valve Guide Length
J. Valve Guide Inside Diameter
K. Valve Guide Outside Diameter
L. Distance from Top Face of Cylinder Head to the Stem End of the Valve Guide
M. Distance from the Bottom Face of the Cylinder Head to the Face of the Valve Seat or Insert
N. Depth of Valve Seat Insert Counterbore
O. Diameter of Valve Seat Insert Counterbore

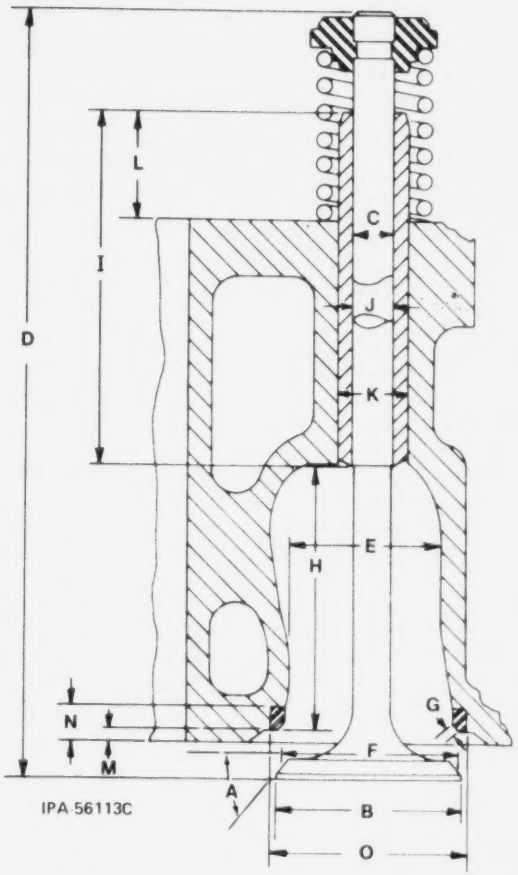



**Fig. 52. Exhaust Valve and Intake Valve with Insert.**

## 9. REASSEMBLY

**Valves**

1. Coat the valve stems with clean SAE-50 oil and insert them from the bottom of the head. Each valve and its parts must be returned to the position from which it came.

2. Place the spring seat, spring, and positive valve rotator on the valve stem. With a valve spring compressor, compress the spring far enough to install the valve locks in the groove at the top of each valve stem. Install all valves in the same manner.

**Valve Lever and Shaft Assembly (Refer to Fig. 4)**

3. Install both of the intermediate valve lever brackets (25) onto the shaft (21) with one set of rocker levers (28) and spacer (33) between them (Fig. 24). Do not tighten the intermediate bracket set screws.

4. Place the remaining rocker levers on the shaft (three on each side of ther intermediate brackets and two levers and one spacer on each side). Turn the shaft in the brackets so that the slot at the rear of the shaft is up. Install the rear valve lever bracket (17) so that the roll pin in the bracket engages the slot in the shaft. Install the front valve lever bracket (34).

### 10. INSTALLATION

1. Clean the injection nozzle copper sleeves with a clean cloth wrapped around a wooden stick (never use a screwdriver or sharp metal object which might damage the sleeves).

2. Install a new cylinder head gasket and, with the aid of a hoist, install the cylinder head. Be sure the locating dowel pins in the crankcase align with the dowel holes in the cylinder head.

**NOTE:** *With the following procedure, it is essential that Dow Corning Molykote "G-n" or Fel Pro C-670 lubricant be used where specified.*

3. Apply Dow Corning Molykote "G-n" or Fel Pro C-670 lubricant at the nut end of the cylinder head studs and both sides of the flat washers. Install the flat washers and nuts on all of the short cylinder head studs, but do not torque them (see NOTE).

**NOTE:** *The center stud may be equipped with a special crab.*

**Fig. 53. Torquing Injection Nozzle Crab Bolt.**

4. Install the injection nozzles into the sleeves. Place the nozzle crab into position and install the dished washer and crab bolt. Tighten the bolt (Fig. 53) to 40 N.m (30 ft-lbs) torque.

5. Connect the fuel supply tubes to the injection nozzles. (See NOTE.)

**NOTE:** *Care must be taken when fitting the nozzle supply tubes. Binding must not exist when the lines are tightened down. The supply tube lock nut must be left loose until the fuel tubes are positioned and connected to the valve housing and then tighten down.*

6. Install the valve push rods.

7. Install the valve bridges and adjust them as follows:

a. Loosen the bridge adjusting screw nut (1, Fig. 58) and back out screw (2) several turns making sure it is not in contact with the valve stem.

b. Firmly press straight down on the rocker arm just above the point of contact with bridge.

c. Turn the adjusting screw (2, Fig. 58) down until contact is made with the valve stem (opposite cam side). Turn the screw an additional 20 to 30 degrees (1/3 flat on nut). Release pressure on rocker arm and torque nut (1) to 47 N·m (35 lbf-ft) while holding screw in position.

d. Adjust all the remaining valve bridges in the same manner.

8. Install the valve lever assembly and the remaining cylinder head nuts and flat washers. Be sure that all rocker levers are in the push rod sockets. Tighten down the valve lever assembly, but do not torque the nuts.

9. Tighten the valve lever shaft set screws and lock nuts in the intermediate valve lever brackets. Install the two cap screws and flat washers securing the intermediate valve lever brackets to the cylinder head.

10. Install the water transfer tube (50, Fig. 4). Install the intake and exhaust manifolds. (Refer to Par. 3.) Do not install the turbocharger or intercooler at this time (if equipped.)

**NOTE:** *If cylinder head nuts are to be torqued before installing the intake and exhaust manifolds, be sure to line up the two heads fore and*

*aft before torquing. This can be done by placing a straight-edge on the machined surfaces to which the manifolds are bolted. This prevents distortion and leakage of the manifold flanges.*

11. Torque the cylinder head nuts in the sequence shown in Fig. 54. Do not tighten to full torque immediately. The nuts must be torqued in seven steps, as shown in Fig. 54.

**NOTE:** *Dow Corning Molykote "G-n" or Fel Pro C-670 lubricant must be used when following this torque procedure. (For applying lubricant, see Par. 10 "INSTALLATION" in Section 2.)*

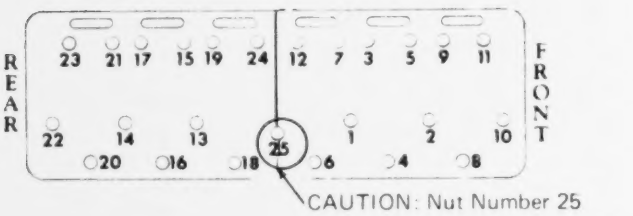



**Fig. 54. Sequence for Tightening Cylinder Head Nuts.**

1st Step — 175 N.m (130 ft-lbs).

2nd Step — 270 N.m (200 ft-lbs).

3rd Step — 340 N.m (250 ft-lbs).

4th Step — Loosen one nut at a time (1/4 turn) and torque to 407 N.m (300 ft-lbs) in sequence shown.

5th Step — If stud No. 25 is equipped with a crab assembly, loosen nut No. 25 (1/4 turn) and torque to 570 N.m (420 ft-lbs).

6th Step — After engine is run under load and operating temperature is attained, loosen one nut at a time (1/4 turn) and torque to 407 N.m (300 ft-lbs) in sequence shown (see NOTE).

**NOTE:** *If stud No. 25 is equipped with a crab assembly, loosen nut No. 25 (1/4 turn) and torque to 570 N.m (420 ft-lbs).*

7th Step — A second retorque must be done after the engine has acquired 50 hours. Torque by row (not by sequence), mark relation of socket to cylinder head, back off 1/4 turn and bring to final torque or back to original position which ever is higher.

12. Install the valve housings to the cylinder heads (using new gaskets). Torque the housing cover post bolts to 75 N·m (55 ft-lbs). Install the clamps and torque screws to 27 N·m (20 ft-lbs) for aluminum clamps or 47 N·m (35 ft-lbs) for gray iron. Install housing covers.

13. Connect the fuel return tube to the injection nozzles and valve housings. Connect the fuel supply tubes to the valve housings. (See NOTE.)

**NOTE:** *Care must be taken when fitting the return tubes. Binding must not exist when the tubes are tightened down. The tube lock nuts must be left loose until the fuel lines are positioned and then tighten down.*

14. Install the turbocharger and intercooler (if equipped). (Refer to Par. 3.)

15. Secure the front and rear water manifolds to the cylinder heads. Tighten clamps on hose connecting front and rear water manifolds together. Connect the water outlet and bypass hoses to the thermostat housing.

**NOTE:** *If they were removed, install the air compressor water inlet hose and the alternator brace to the thermostat housing and install the intercooler water inlet hose to the rear water manifold.*

16. Connect the fuel return line.

17. Install the final fuel filter and fuel reservoir (if equipped) to the rear water manifold and connect all fuel lines.

18. Install the lubricating oil filter assembly. (Refer to Section 7, "LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS.")

19. Lubricate the threads of fuel line nuts with diesel fuel or flushing fuel. Connect the fuel lines to the injection pump and valve housings. Torque nuts at pump to 40 N·m (30 ft-lbs) and nuts at valve housings to 55 N·m (40 ft-lbs).

20. Fill the complete cooling system. Be certain that the radiator and cylinder block drain valves are closed. Also close the vent valve on the water manifold after venting the system. Check the oil level in the crankcase.

21. Adjust the valve lash to the cold setting as outlined in Par. 11.

# MANIFOLD, CYLINDER HEADS AND VALVES

22. Pressure test the valve housing-to-injection nozzle lines. Connect a test pump (Kiene or equivalent) to the injection nozzle pipe inlet elbow outside of the valve housing, using Kiene adapter 4092. Be sure the engine timing pointer is set at "1-6" mark (Fig.55) on the vibration damper for the cylinder and injector to be tested.

23. Build up 20685 kPa (3000 psi) pressure on the test pump gauge and look for leaks at the following points:

a. Connector nut at housing fitting.

b. Fittings at each end of the injection lines.

c. Connector nut at injection nozzle inlet elbow.

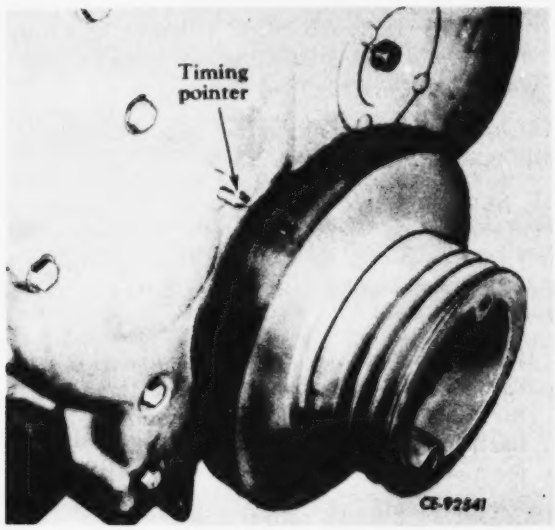



**Fig. 55. "1-6" Timing Mark**

24. If leaks are found and further tightening does not stop the leaks, replace defective parts.

25. Pressure test the return lines. Connect the test pump to the return line tee or elbow, using Kiene adapter 4092. Apply 172 kPa (25 psi) pressure and look for leaks at all the connector nuts and return lines. If pressure cannot be maintained, look for leakage around the injection nozzle fittings. Defective fittings must be replaced.

26. Hand prime the fuel system. Refer to Par. 12 "HAND PRIMING FUEL SYSTEM" in this section.

## 11. VALVE LASH ADJUSTMENT

Whenever the cylinder heads have been removed and replaced or the cylinder head retorqued, it will be necessary to adjust the valve lash before starting the engine.

**CAUTION! As a safety precaution, remove the battery cable from the cranking motor before making any adjustments.**

**NOTE:** *Before adjusting valve lash, be sure the valve bridges have been adjusted as described in Par. 10.*

Following this simplified procedure, all valves can be adjusted quickly and accurately. Note that the engine need not be cranked six times to position the piston of each cylinder on TDC. All valves are adjusted by cranking the engine only twice.

1. Remove the cover and gasket from both cylinder heads. Turn the crankshaft until the number one piston is on the compression stroke and the timing pointer on the front cover is in line with the TC mark on the vibration damper (Fig. 56). Fig. 57 shows the numbering sequence of the valves.

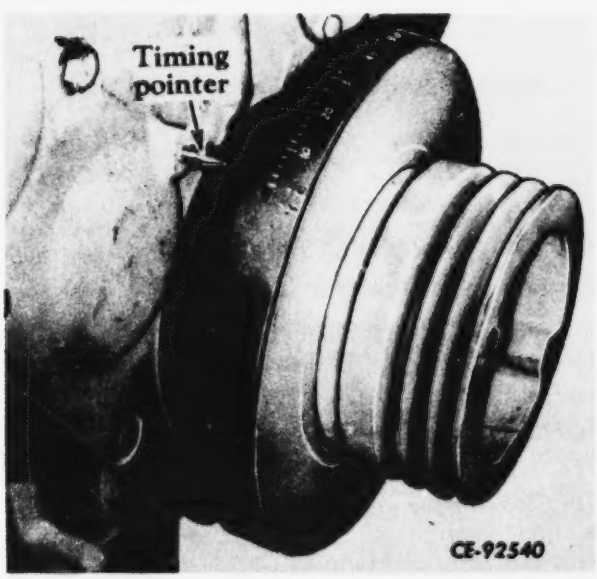



**Fig. 56. Showing "TC" Marks on the Vibration Damper**

**NOTE:** *Be sure that the number one piston is on the compression stroke by turning both push rods by hand to determine that both intake and exhaust valves are closed. Valves are closed when push rods are loose and can be turned easily.*

2. In this position, adjust the intake valves (as described in Step 4) for cylinders 1, 2 and 4; and the exhaust valves for cylinders 1, 3 and 5.

3. Rotate the crankshaft one full revolution until the No. 6 cylinder is at TDC (compression). In this position, adjust the intake valves (as described in Step 4) for cylinders 3, 5 and 6; and the exhaust valves for cylinders 2, 4 and 6.

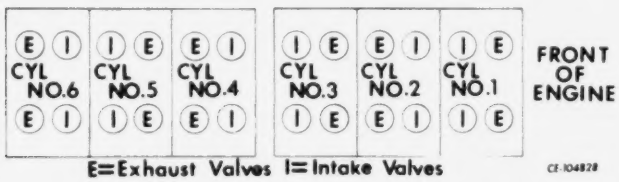



**Fig. 57. Valve Arrangement.**

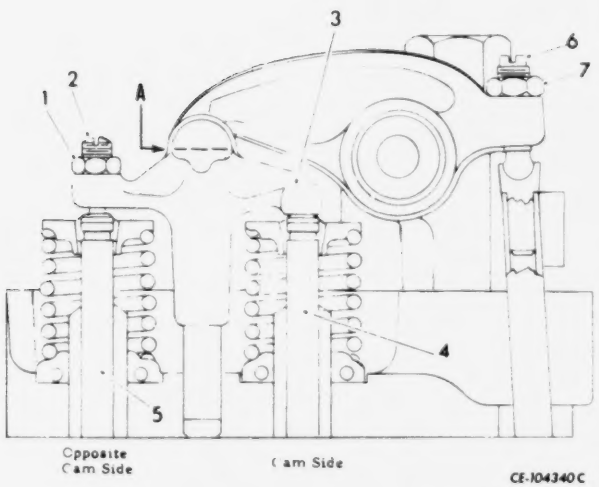



**Fig. 58. Valve Lash Adjustment.**

1. Bridge Adjusting Screw Nut
2. Adjusting Screw
3. Bridge
4. Valve (cam side)
5. Valve (opposite cam side)
6. Rocker Lever Screw
7. Rocker Lever Screw Nut

4. Loosen rocker lever nut (7, Fig. 58) and screw (6). Insert feeler gauge (refer to "SPECIFICATIONS" in Section 1 for proper size) between rocker lever and valve bridge (A, Fig. 58) (see NOTE). Turn adjusting screw (6) until bridge just touches feeler gauge. Hold screw in position and tighten jam nut (7) to 115 N· m (85 lbf-ft).

**NOTE:** *Feeler gauge must not be more than 9.5 mm (3/8 inch) wide to insure a free fit between ears of bridge.*

5. Using new gaskets, install the valve covers.

## 12. VALVE TIMING (CAMSHAFT) CHECK

1. Make sure that the valve lash is set to the specifications.

2. Rotate the crankshaft until either No. 1 or No. 6 piston is on top dead center compression stroke.

3. Position a dial indicator on one of the two exhaust valve rotators and set the indicator to zero.

4. Rotate the crankshaft clockwise (viewed from front) to $20^{0}$ before top dead center.

5. The dial indicator reading should be between 4.45-5.59 mm (0.175-0.220 inch).

## 13. HAND PRIMING FUEL SYSTEM

1. TD-25C only: Open vent on *primary* fuel filter until fuel flows free of air bubbles.

2. Unlock the hand primer by rotating plunger counterclockwise.

3. Open vent on top of *final* fuel filter header.

4. Pump the hand primer until a stream of fuel comes out of the vent.

5. Close the vent on filter.

6. Lock hand primer by depressing plunger and rotating clockwise until tight (see NOTE).

**NOTE:** *If hand primer plunger is not tight, it will back out due to vibration during operation and it will literally blow out.*

7. Engines not equipped with fuel reservoir: After engine is started and running at low idle, reopen vent on final fuel filter until fuel flows free of air bubbles.

## CONNECTING RODS, PISTONS AND RINGS

### 1. DESCRIPTION

**Connecting Rods**

The connecting rods are forged steel and contain a bushing at the upper end for installaton on the piston pins. This bushing is lubricated by means of a collector cup in the top of the connecting rod. Oil from the piston cooling jets drops into the collector cup and reaches the bushing through a drilled passage. The lower end and cap contain the locking type selective fit bearing inserts.

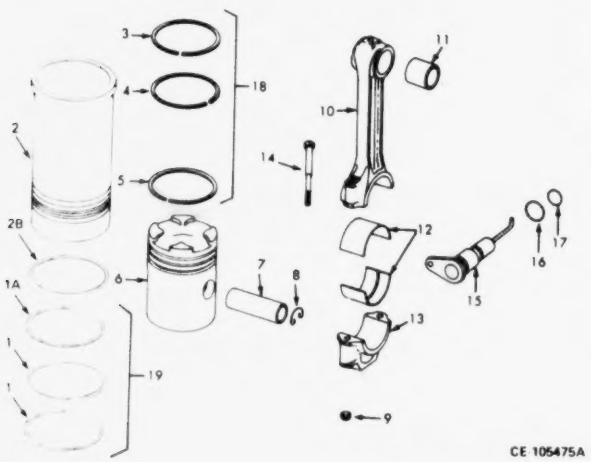



**Fig. 1. Exploded View of Connecting Rod and Piston Assembly**

1. Cylinder Sleeve Packing Ring
1A. Cylinder Sleeve Packing Ring
2. Cylinder Sleeve
2B. Cylinder Sleeve Shim
3. Compression Ring (top).
4. Compression Ring (intermediate).
5. Oil Control Ring
6. Piston
7. Piston Pin
8. Retainer Ring
9. Connecting Rod Bolt Nut
10. Connecting Rod
11. Bushing
12. Connecting Rod Bearing
13. Connecting Rod Cap
14. Connecting Rod Bolt
15. Piston Coolant Jet
16. "O" Ring
17. "O" Ring
18. Piston Ring Set
19. Packing Ring Set

**Pistons and Rings**

The pistons are cast aluminum alloy and are cam ground. They are fitted with two compression and one oil control rings.

Pistons receive the force of combustion pressure and transmit it to the connecting rod and crankshaft. The escape of combustion pressure past the piston is prevented by the piston rings. The fit of the piston and rings in the sleeve must be close enough to prevent the escape of combustion gases, yet be free enough to keep friction to its working minimum.

The oil regulating ring provides an even circulation of lubricating oil and therefore, an overall lubrication and cooling action for the piston and crankcase sleeve. Excess oil is wiped by the rings, back down to the crankcase. The two top rings are compression rings. Ring gaps and other dimensions are given in Section 1, "SPECIFICATONS."

**Piston Pins**

The piston pin is hardened steel and anchors the piston to the connecting rod. The pin is retained in the piston by retainer rings that lock into the grooves of the pin bore. The pin floats in its bushing in the upper end of the rod. The aluminum alloy of the piston is an excellent bearing material and no bushing is required between the pin and the piston. Specified clearances are given in Section 1, "SPECIFICATONS."

### 2. REMOVAL

1. Remove the cylinder heads. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES.")

**NOTE:** *Whenever cylinder heads are removed, new cylinder head gaskets must be installed.*

2. Remove the drain plug and drain the crankcase oil pan. Remove the cap screw securing the scavenging oil pump manifold to the scavenging pump (if equipped). Remove the oil pan with scavenging pump manifold attached. Remove the oil suction pipe that is attached to the crankcase.

3. Remove the piston cooling jets from the right side of the crankcase (Fig. 2). Remove the cap screw securing the jet to the crankcase. Turn the jet 1/4 turn clockwise so that the end of the flange, with the cap screw hole, is pointing up (Fig. 3). The 1/4 turn is necessary to clear the skirt of pistons that are at the bottom of the stroke. DO NOT turn the jet counterclockwise or the jet tube will strike the piston skirt. When the jet is positioned as shown in Fig. 3, pull the

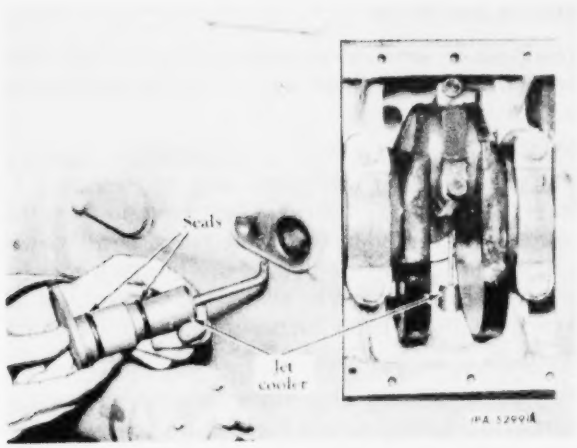



**Fig. 2. Removing Piston Cooling Jet**

jet straight out, maintaining its position. If the cooling jet binds, use pry bars to pull it loose from the crankcase.

**NOTE:** *The jet cooler tubes are set at a 92 degree angle, so that the oil is directed to a particular spot on the underside of the piston. Therefore, careful handling of this assembly is extremely important. Also NEVER remove a piston without first moving the piston cooling jet.*

4. Crank the engine until the connecting rod to be removed is at its lowest position. Remove the elastic stop safety nuts and bearing cap. Tap the cap lightly with a mallet if necessary to aid removal. The lower bearing insert is removed with the cap. The upper half of the bearing will remain on the connecting rod.

**NOTE:** *If a ridge exists on the cylinder sleeve at the upper end of the ring travel, the ridge must be removed by using a ridge grinder before the piston is removed. This prevents damage to the piston ring lands during removal of pistons, and prevents damage to new top piston rings after the installation of new rings.*

5. Push up on the connecting rod until the piston is clear of the sleeve and lift the assembly out of the top of the sleeve (Fig. 4).

**NOTE:** *Pistons must be handled with care to avoid damage and knocking out-of-round or alignment. When removing a piston from the crankcase, do not allow the skirt of the piston to strike the crankcase or connecting rod. Mark the pistons, connecting rods and connecting rod bearing caps so that they can be installed in the same cylinders from which they were removed, and in the same position.*

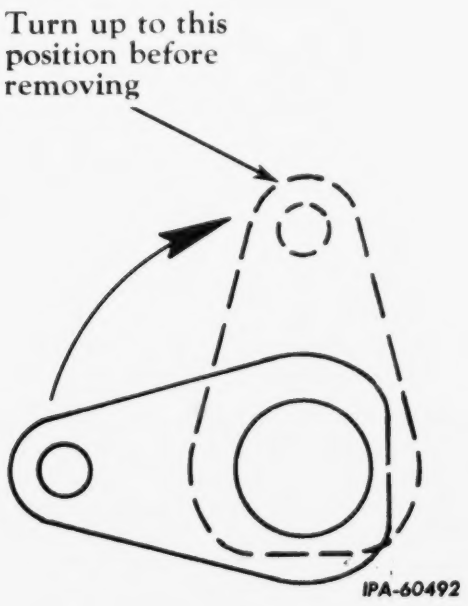



**Fig. 3. Correct Position for Removing Cooling Jet**

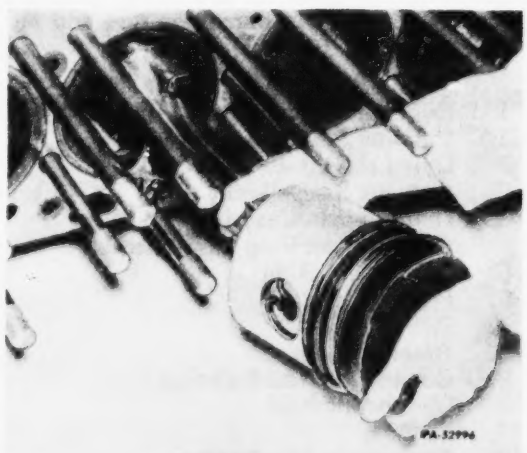


**Fig. 4. Removing Piston and Connecting Rod**

### 3. DISASSEMBLY

1. With the aid of piston ring expander remove the piston rings, top ring first and the remaining rings in order (Fig. 5).

2. Remove the piston pin retainer rings from each side of the piston, and remove the piston pin. If the piston pin cannot be removed by hand, it is recommended to heat the piston in water to 71°-82° C (160°-180° F). This heating of the piston makes it unnecessary to use force in removing the pins.

**Fig. 5. Removing Piston Rings**

3. After the pin is removed, separate the piston from the connecting rod. Precaution must be taken to see that the parts are marked so they may be reinstalled in their respective cylinders, unless defective.

### 4. INSPECTION AND REPAIR

**Piston and Piston Pins**

1. Immerse the piston and piston pin in cleaning solvent and clean thoroughly.

**NOTE:** *Never use a caustic solution for cleaning the pistons.*

2. Clean all carbon from the piston ring grooves, using ring groove cleaner (Fig. 6) or a broken piston ring. Be sure that all oil holes in the piston are open.

3. Inspect the pistons for scuffed or scored skirts and cracked or worn piston ring lands. Discard any showing such conditions.

4. Inspect the piston pins for wear. Replace any pins which show signs of corrosion or etching.

5. To check the piston pin fit, the pins and pistons must be at room temperature (21° C (70° F). The pin should be a "palm push" fit under these conditions. (Refer to "SPECIFICATIONS" in Section 1.)

**NOTE:** *This fit is common on both sides of the piston.*

**Fig. 6. Cleaning Piston Ring Grooves**

6. Check the piston clearance in the sleeves as follows:

a. Measure the inside diameter of the sleeves with a dial bore gauge (Fig. 7). Take measurements at right angles.

b. Measure the outside diameter of the piston at the bottom of the skirt as shown in Fig. 8.

**NOTE:** *The piston is cam ground, therefore it has two different diameters. The one across the piston pin bosses is less than the diameter across the thrust face. In order to check the piston to sleeve clearance, it is necessary to measure the skirt at 90° to pin centerline.*

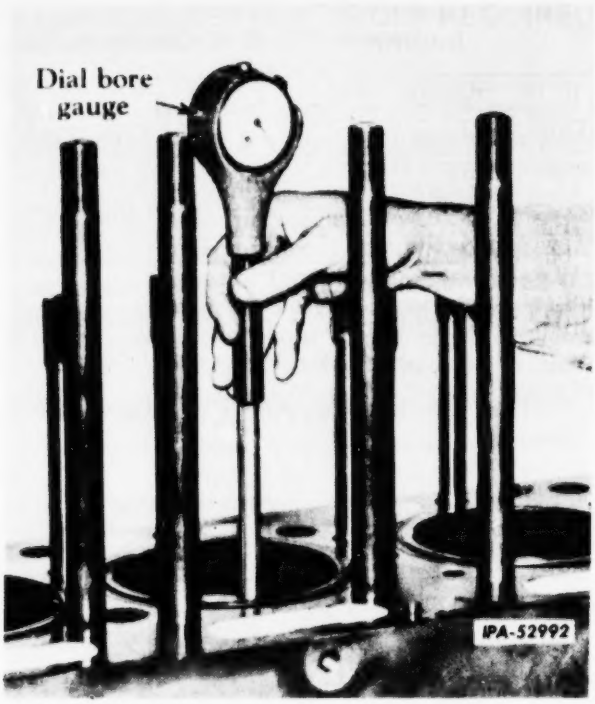



**Fig. 7. Checking Sleeve ID**

**Fig. 8. Checking Piston OD**

c. Subtract the outside diameter of the piston from the inside diameter of the sleeve to obtain the existing clearance. The specified clearance is given in "SPECIFICATONS" in Section 1.

**Connecting Rods**

7. Clean the connecting rod thoroughly and visually inspect for defects. Be sure the collector cup at the top of the connecting rod is clean and open. Inspect the connecting rods for straightness. The rods must be free of twist and be parallel to the pistons.

8. Check the fit of the piston pin in the connecting rod bushing for proper clearance. If greater than the maximum allowable clearance specified in "SPECIFICATIONS" in Section 1, replace the bushing. (Refer to "PISTON PIN BUSHING REPLACEMENT" in this section.)

9. Connecting rod bolts and nuts must be cleaned of all foreign matter including the anti-rust materials that may be caked in the threads.

A good method of checking to determine thread condition is to turn the connecting rod nut (threads lubricated with a light engine oil) all the way into the connecting rod bolt with the fingers.

If the nut runs on relatively free without sticking the bolt and nut is satisfactory for use.

Connecting rod nut and bolt thread condition is most important. Threads that are dry, excessively rough, battered or that are filled with dirt, require considerable effort just to rotate the nut. Then, when the clamping load is first developed, or the bolt tension is applied, the torque reading mounts rapidly (due to thread friction) to the specified figure without approaching the desired bolt tension and maximum clamping effect. Under these condi-tions the desired torque reading is obtained but the clamping effect might be far below requirements, leading to bearing failure or to connecting rod bolt breakage. The proper bolt tension and clamping effect can never be attained if the bolt is dry. The bolt and nut must have a film of clean engine oil on the thread section and under the nut.

**Piston Rings**

**NOTE:** *Faulty rings cannot always be detected by the eye. Engine performance and irregularities such as excessive oil consumption must be taken into consideration. Therefore it is recommended whenever a piston is removed from the cylinder, new rings should be installed.*

10. Inspect the new rings for any sign of damage before installing them (see NOTE).

**NOTE:** *The witness lap on the rings does not extend to the end gap.*

11. Prior to installing the rings on the pistons, each ring must be checked for proper ring gap. Push the ring down into the cylinder sleeve with a piston. This will position the ring squarely in the sleeve. Extreme caution must be used during this operation. Check the space or gap between the ends of the ring with a feeler gauge (Fig. 9). (Refer to "SPECIFICATIONS" in Section 1 for proper ring gap.) Replace if not as specified.

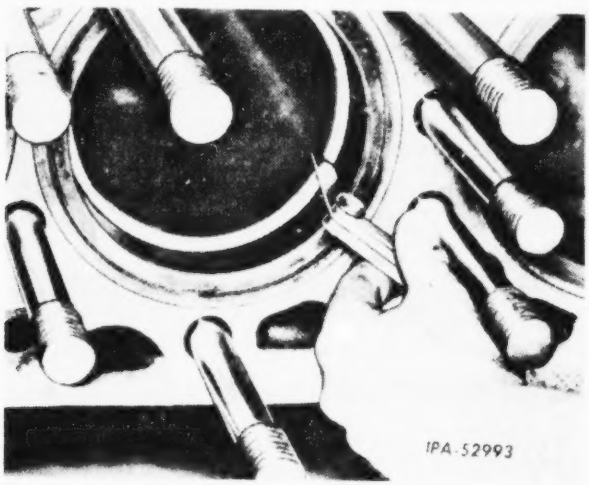



**Fig. 9. Checking Piston Ring Gap**

12. OIL RING: Check the oil ring as follows:

a. Inspect the "Windows" of the oil ring and piston for blocked oilways. Failure to keep the oilways clear will result in uneven lubrication and "hot-spots" of the piston and cylinder sleeve.

b. With a feeler gauge, check the side clearance of the ring in its groove (Fig. 10). (Refer to "SPECIFICATIONS" in Section 1 for proper clearance.)

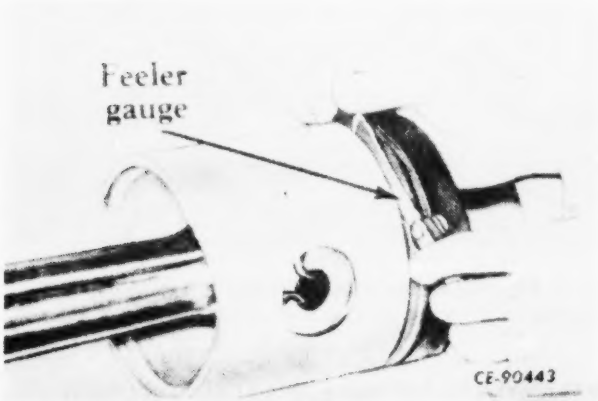



**Fig. 10. Checking Piston Ring Clearance in Oil Ring Groove**

**NOTE:** *On a used piston, it will probably be found that the side clearances tend to increase toward the top of the piston due to the greater operating temperature prevalent at this point.*

13. COMPRESSION RINGS (KEYSTONE): Check the compression rings as follows:

a. Check the compression ring grooves using a new keystone ring to correctly establish the piston groove wear.

b. Obtain a Perfect Circle piston ring gauge No. 1 (1/8 inch by 15 degrees) and insert it in the ring groove. If one or both of the shoulders on the gauge touch the ring groove land (Fig. 11), the piston must be replaced. A groove worn this much would not support the ring in operating position. Install a new piston and rings.

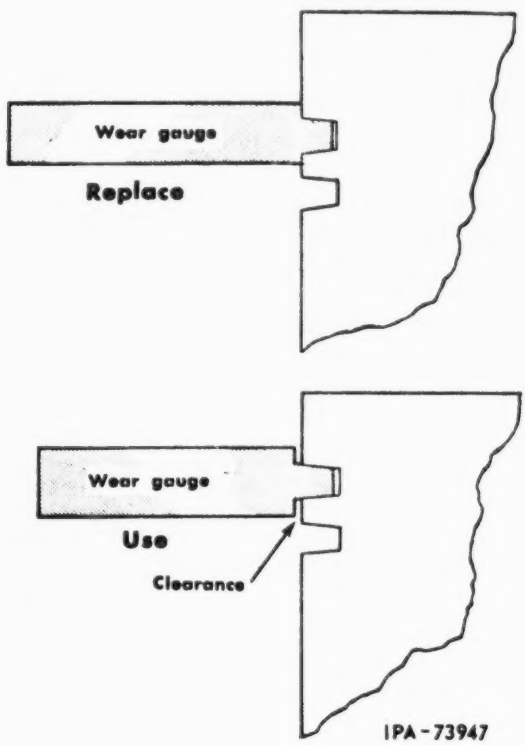



**Fig. 11. Checking Piston Compression Ring Grooves**

**NOTE:** *The following checks are made to make certain that the top compression ring fit is correct and not carrying the piston load.*

c. Install the correct compression ring in the top piston groove and be sure it is seated into the groove.

d. Position a dial indicator gauge on the special service tool PLT-501 (Fig. 12).

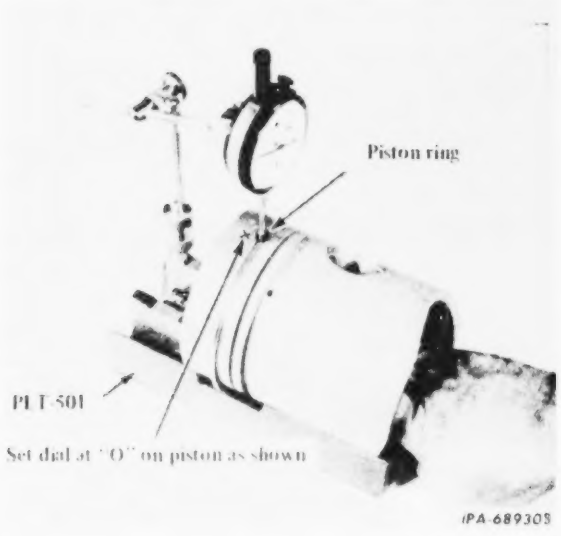



**Fig. 12. Checking Piston Ring "Drop"**

e. Position the piston on the tool (piston ring in the clearance slot of the tool), and locate the piston land directly above the ring under the indicator pointer.

f. Set the pointer at "O", slide the piston forward (toward the gauge) until the pointer rests on the ring. Note the dial reading. It must read 0.05-0.38mm (0.002-0.015 in.) below the piston land.

**IMPORTANT:** *Be sure that the piston ring is seated in its groove.*

g. Repeat Step (f) at four positions 90 degrees apart.

**NOTE:** *When new rings are being installed to a used piston for operation in a used sleeve, wear on the sleeve may have left a ridge where the piston reaches the top of its stroke. This ridge will cause noisy engine operation and breakage of the top ring. Remedy this by removing the ridge with a ridge grinder before installing the piston and ring.*

### Piston Pin Bushing Replacement

14. Replace connecting rod bushings using the bushing removal and installing tool, PLT-544-1 which consists of items (1 through 5) shown in Fig. 15. A center line is scribed on the block (4) and sleeves (2) to insure locating the correct position of the bushing to the connecting rod.

15. (Refer to Fig. 13 and 14): Remove the old bushing as follows:

a. Using a suitable arbor press, position the connecting rod on the block (4).

b. Assemble the removing sleeve (3) on the mandrel (1). Place the assembled tool on the connecting rod, indexing the center line mark on the sleeve (3) with the center line mark on the block (4). Place the guide sleeve (5) on the lower end of the mandrel (1) in the block (4) to act as a guide. This will also center the connecting rod bushing with the hole in the block.

c. Press bushing until half way removed.

d. Remove tool and reassemble guide sleeve (5) on mandrel between mandrel head and sleeve (3) to provide increased tool travel.

e. Reinstall tool into connecting rod and press bushing out.

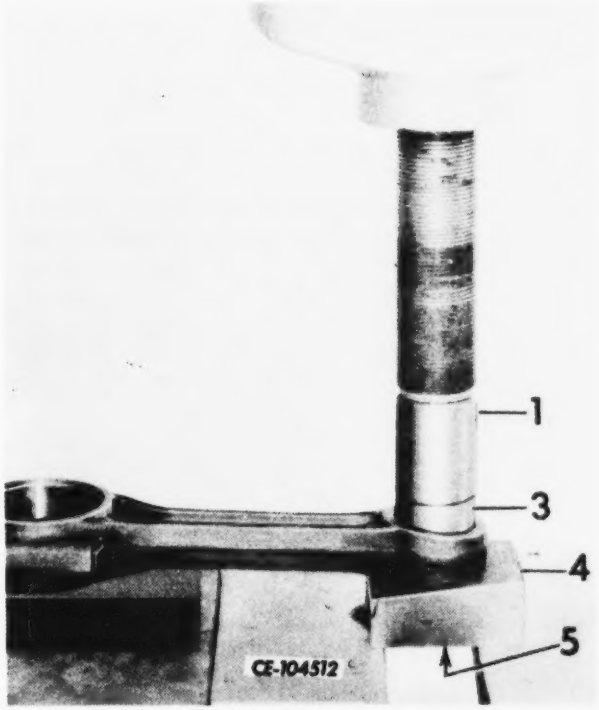



**Fig. 13. Removing Bushing (First Step)**

1. Mandrel
3. Removal Sleeve
4. Block
5. Guide Sleeve

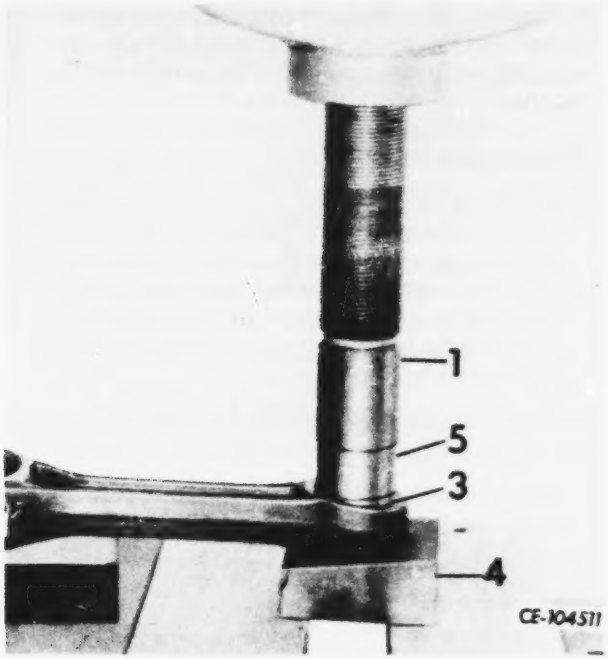



**Fig. 14. Removing Bushing (Second Step)**

1. Mandrel
3. Removal Sleeve
4. Block
5. Guide Sleeve

16. (Refer to Fig. 15): Install the new bushing as follows:

a. On mandrel (1) assemble sleeve (2), new piston pin bushing (6), sleeve (3) and guide sleeve (5).

b. Place connecting rod on block (4) in horizontal position.

c. Assemble the mandrel with all components described in Step a. into the connecting rod bushing bore. Make sure the scribe mark on sleeve (2) lines up with scribe mark on block (4).

d. Using a suitable arbor, press the bushing into the bore until the sleeve (2) contacts the connecting rod.

e. Check bushing to be sure bushing did not rotate during assembly.

f. Burnish and finish ream the bushing to the dimension shown in "SPECIFICATIONS" in Section 1. Break edges of bushing bore (both sides) to 0.50mm (0.020 in.).

17. Wash the piston cooling jets in an oil solvent and dry thoroughly with compressed air. Be sure that the oil passage in the body and the tube is open and clean. Discard the sealing "O" rings if they show any signs of damage.

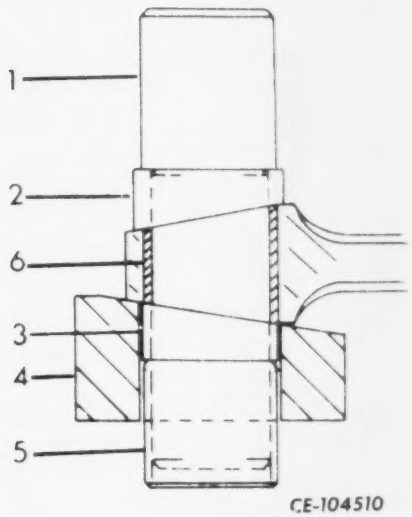



**Fig. 15. Installing Connecting Rod Bushing**

1. Mandrel
2. Sleeve
3. Sleeve
4. Block
5. Guide Sleeve
6. Bushing

18. The thick wall cooling jets (3/8 inch OD tube) are accurately aligned when manufactured to provide the correct spray angle. Stiffer construction insures that they will retain this angle through normal handling. If a jet tube is obviously abused and damaged, it must be replaced.

## 5. REASSEMBLY

1. Generously coat the piston pin with Moly Kote "G-n" or Fel-Pro C-670.

2. Position the connecting rod inside the piston. Align the bushing in the rod with the piston pin holes in the piston and push the piston pin completely into position.

3. Squeeze the pronged ends of the piston pin retainer rings, and install a ring in the groove at each side of the piston to secure the piston pin.

4. Check the fit of the piston pin in the piston for proper end clearance as follows:

a. Push one end of the piston pin until it reaches a definite stop against the retainer ring on the opposite side of the piston.

b. Position a feeler gauge between the end of the pin that was pushed in and the retainer ring to check for end clearance (Fig. 16) as specified in "SPECIFICATIONS" in Section 1.

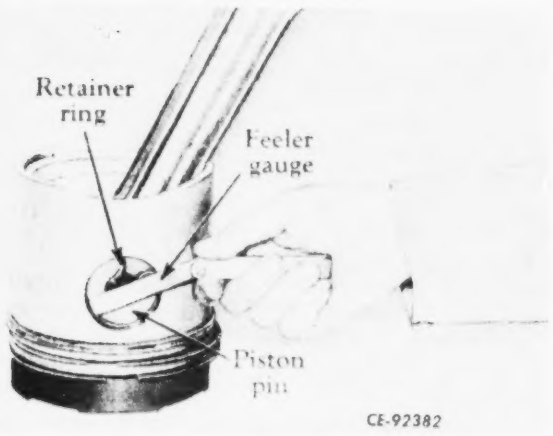



**Fig. 16. Checking Piston Pin End Clearance**

5. Using a piston ring expander (Fig. 5), install the rings into the grooves of the pistons. (Refer to Fig. 17 for correct position of rings for piston.) The oil regulating ring coil spring must be installed in groove before the ring. Also the coil spring joint must be approximately 180 degrees from the ring gap.

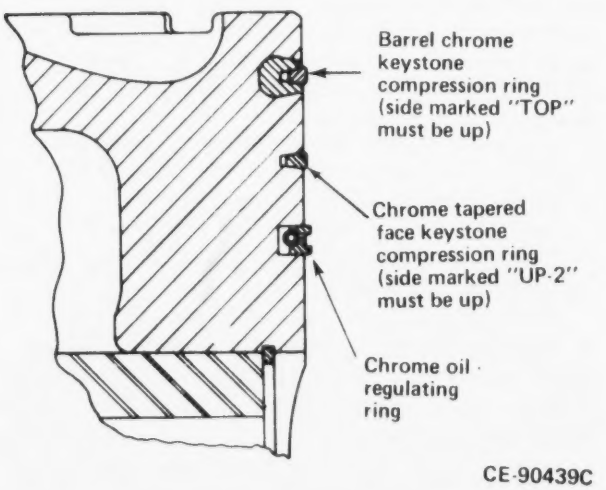

Barrel chrome keystone compression ring (side marked "TOP" must be up)
Chrome tapered face keystone compression ring (side marked "UP-2" must be up)
Chrome oil regulating ring
CE-90439C

**Fig. 17. Piston Rings Correctly Installed on Piston**

6. Position the rings, so that the gaps are 90 degrees from the thrust side of the piston (in line with the piston pin bore) and 180 degrees from one gap to another.

## 6. INSTALLATION

**NOTE:** *When installing a piston and connecting rod assembly which was formerly used in the engine, install the assembly in the same cylinder from which it was removed. When a new piston or a new piston and connecting rod assembly is being installed, install a matched set of pistons and sleeves.*

1. The piston and connecting rod assemblies must be installed through the top of the crankcase.

2. Coat a piston and piston ring compressor with clean lubricating oil.

3. Install the piston and rod assembly into the piston ring compressor.

4. Coat the cylinder sleeve with a generous amount of clean lubricating oil. Install the compressor, with piston and rod, into the cylinder sleeve (Fig. 18) with the cylinder number stamped on the connecting rod, facing the camshaft side of the engine. Push down on the piston carefully until it is in the cylinder sleeve.

**Fig. 18. Installing Connecting Rod and Piston**

5. Coat the connecting rod journal and connecting rod bearings with clean lubricating oil. Install the upper half of the bearing in the connecting rod and pull the rod down onto the journal. Coat the threads of the connecting rod studs with engine oil. Install the connecting rod bearing cap to the connecting rod. Match the cap and rod with marks previously made for removal and tighten to 203 N.m (150 ft-lbs).

**NOTE:** *The connecting rod bearings must be fitted, bearing clearance checked and connecting rod end play checked, as outlined in Par. 7, before continuing the assembly of the engine.*

6. Install the remaining connecting rods and pistons in the same manner.

7. Insert the piston cooling jets (Fig. 2). Insert the jet with the hole in the end of the flange pointing up (Fig. 19). When the jet is all the way in, turn it counterclockwise into position and secure it with the cap screw.

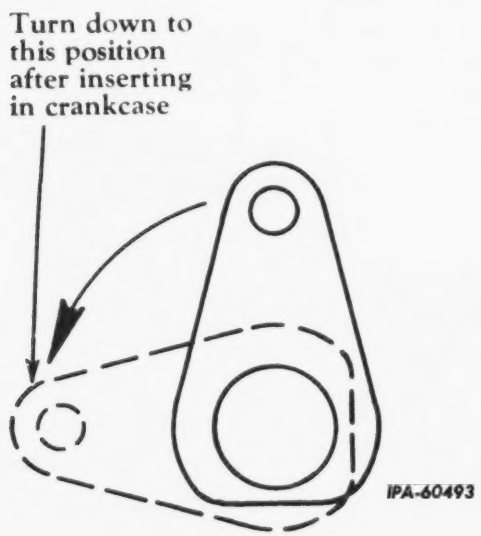



**Fig. 19. Correct Position for Installing Cooling Jet**

8. Install the oil suction pipe to the crankcase. Use a new gasket where the pipe attaches to the front cover. Install the crankcase oil pan with new gasket and scavenging pump manifolds (if equipped). Be sure that the scavenging oil pump manifold "O" rings are in place. Install and tighten the oil pan drain plugs to 47 N.m (35 ft-lbs) torque.

9. Install the cylinder heads. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES.")

10. After the installation of new piston sets or new piston rings, the engine must be "run-in" according to the conditioning schedule given in Par. 12, "ENGINE RUN-IN SCHEDULE," before operating at normal load and speed.

## 7. BEARING FITTING PROCEDURE

### General

1. Undersize precision-type bearing shells should be installed when, because of wear, bearing-to-crankshaft running clearances are to be reduced.

**NOTE:** *Bearing caps must not be filed, lapped, or modified in any other manner.*

2. Premature bearing failure will result from attempts to reduce journal-to-bearing running clearances by modifying bearing caps, bearings, or both, because such modifying will alter the engineered fit of the bearing shells in their bores and destroy the specifically desired "crush."

3. When installing precision-type connecting rod or main bearings, it is important that the bearing shells fit tightly in the rod or case bore. To accomplish this, the bearing manufacturer makes the diameter at right angles to the parting line slightly larger than the actual diameter of the bore into which they are assembled. When the assembly is drawn up tight, the bearing is compressed, assuring a positive contact between the bearing back and the bore. This increased diameter is referred to as "bearing crush" (Fig. 20).

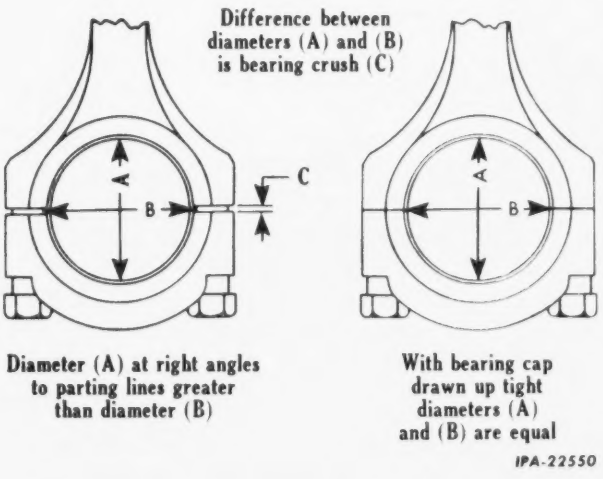

Difference between diameters (A) and (B) is bearing crush (C)
A
B
C
A
B
Diameter (A) at right angles to parting lines greater than diameter (B)
With bearing cap drawn up tight diameters (A) and (B) are equal
IPA-22550

**Fig. 20. Illustrating Bearing Crush**

4. To obtain proper bearing assembly with the correct "crush," be careful when tightening the clamping bolts or nuts to be sure they are drawn down alternately and evenly, using a tension wrench and tightening as specified.

5. Rods, caps or blocks must not be filed, lapped, or modified in any other manner in order to reduce clearance. While such practice will make a tighter fit at top and bottom, it will result in an out-of-round bore and bearing shell distortion.

6. Main and connecting rod bearings are designed with the "spread" (width across the open ends) slightly larger than the diameter of the crankcase bore or connecting rod bore into which they are assembled. For example, the width across the rod bearing not in place is approximately 0.64mm (0.025 in.) more than when the bearing is in position. This condition is originally designed into the bearing causing it to spread outward at the parting line when "crush" load is applied by tightening the nuts or bolts. Some of this "snap" may be lost in normal use, but the bearing need not be replaced because of a nominal loss of this condition.

7. This condition causes the bearing to fit snugly in the rod bore and the bearing must be "snapped" or lightly forced into its seat (Fig. 21).

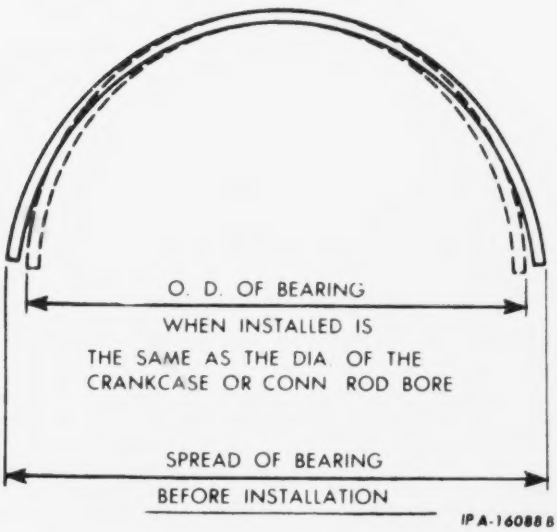



**Fig. 21. Illustrating Bearing Spread**

**Fitting Connecting Rod Bearings**

**NOTE:** *Do not turn the crankshaft during the following procedure.*

8. Remove a bearing cap. If virgin lead wire is to be used, wipe clean and oil the crankshaft journal. If "Plastigage" is to be used, wipe the bearing surface and exposed half of the crankshaft journal free of oil as the plastic material is soluble in oil.

9. Place a suitable length of 0.25mm (0.010 in.) virgin lead wire or a piece of "Plastigage" across the bearing (Fig. 22) and install the bearing cap.

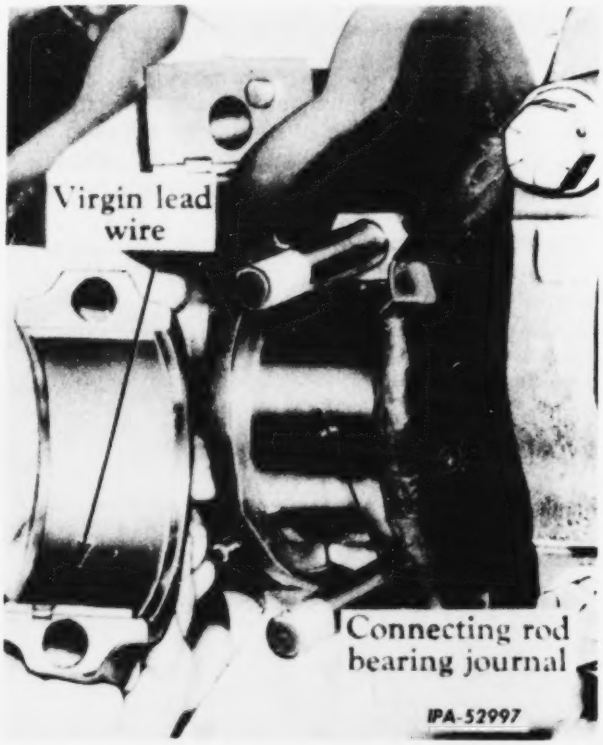



**Fig. 22. Checking Connecting Rod Bearing Running Clearance**

10. Tighten the nuts to the specified torque; then remove the nuts and bearing cap. If virgin lead wire was used, use a micrometer to measure the wire which will have been crushed down to the amount of clearance between the crankshaft journal and the connecting rod bearing by the torque applied to the nuts. If "Plastigage" was used, the flattened plastic material will be found adhering to either the bearing shell or the crankshaft. DO NOT REMOVE THE PLASTIGAGE. To determine the bearing clearance, compare the width of the flattened plastic material at its widest point with the graduation on the

envelope. The number within the graduation on the envelope indicates the clearance in thousandths of an inch.

11. The measurement should fall between the figures given in "SPECIFICATIONS" in Section 1. Reinstall the cap and bearing and torque to the specified amount if reading was as specified. Repeat this procedure for all the remaining connecting rods.

**NOTE:** *Should the reading not fall within the specified limits, remove the bearing from the connecting rod and replace it with a new one. However, with the precision bearings used, no problem should be encountered providing the crankshaft and connecting rod are in good order.*

12. Check the connecting rod end clearance using a feeler gauge as shown in Fig. 23. (Refer to "SPECIFICATIONS" in Section 1 for specified clearance.) Excessive clearance may require replacement of the rods or shaft. The check must be made to be certain that the specified end clearance exists. When checking end clearance, the feeler gauge must cover both the connecting rod and cap. Lack of clearance could indicate a damaged rod or perhaps a rod bearing out of position.

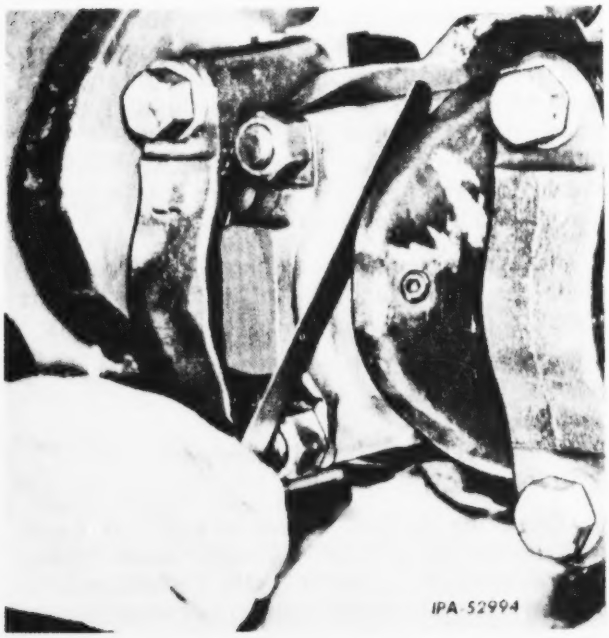



**Fig. 23. Checking Connecting Rod End Clearance**

## CYLINDER SLEEVES

### 8. DESCRIPTION

The cylinder sleeves are the wet type. The bottom of the sleeve is sealed in the crankcase by three "O" rings (Fig. 24). A flange at the top of each sleeve fits into a counterbore in the top of the crankcase and serves to position the sleeve correctly. In some engines, shims may be used between the sleeve flange and crankcase counterbore to provide the correct cylinder sleeve protrusion. The wet type sleeve is water cooled over its entire length. Matched or fitted sleeves and pistons are available for service.

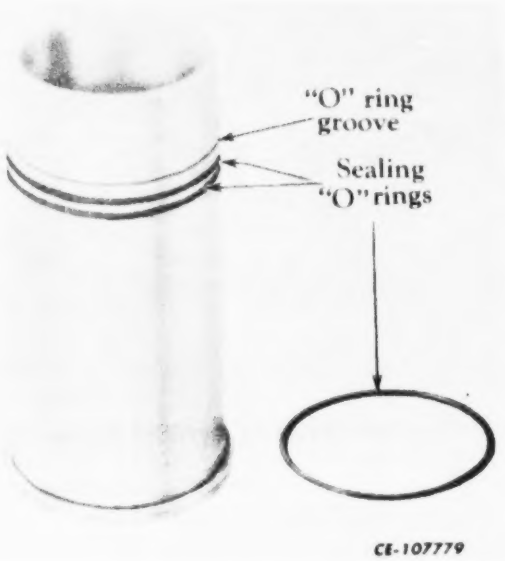



**Fig. 24. Cylinder Sleeve**

### 9. REMOVAL

1. Remove the cylinder heads. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES.")

**NOTE:** *Whenever cylinder heads are removed, new head gaskets must be installed. Refer to "CYLINDER SLEEVE PROTRUSION," under Par. 7 in Section 2 for determining what thickness shim should be used.*

2. Remove the connecting rods and pistons. (Refer to Par. 2.)

**NOTE:** *It is advisable to wrap an oil-soaked cloth around the crankshaft connecting rod bearing journals to keep them as clean as possible. Wrap the piston and connecting rod assemblies in clean cloth also to protect them until installation.*

3. Remove the cylinder sleeves with sleeve puller set, PLT-502-3 (Fig. 25). Remove the shims (if equipped) from the counterbore in the top of the crankcase.

**NOTE:** *If more than one sleeve is to be removed, and they are to be used again, it is important that the sleeves and shims (if equipped) be marked as to their location in the crankcase.*

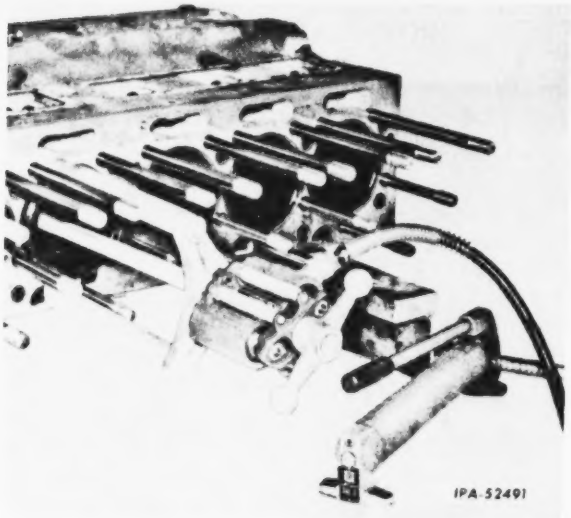



**Fig. 25. Removing Cylinder Sleeve**

## 10. INSPECTION AND REPAIR

1. Remove the packing rings and shims (if equipped) from the cylinder sleeves. (See NOTE.)

**NOTE:** *The upper cylinder sleeve packing ring (Fig. 26) is made of red silicone rubber material. The two lower rings are a black buna rubber material. The red silicone ring MUST NEVER be immersed in, or cleaned with mineral spirits, such as Stoddard Solvent, Oleum or any commercial solvent. Also, do not use gasoline, diesel fuel or kerosene. Mineral spirits will expand the silicone material and could cause damage to the ring when installing the sleeve in the crankcase. It is recommended that this ring be cleaned in water or wiped with a clean rag. The two lower rings can be cleaned in mineral spirits without harmful effect.*

2. Clean the sleeves in a cleaning solvent, and dry them with compressed air. Clean out and flush the water jacket in the crankcase. Thoroughly clean the "O" ring seating surface in the crankcase sleeve bore.

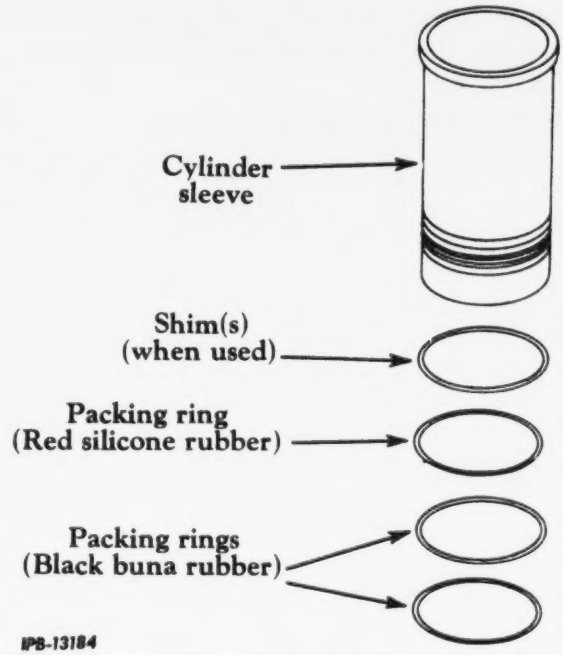



**Fig. 26. Cylinder Sleeve with Packing Rings and Shims**

**NOTE:** *Do not use abrasive material to clean the cylinder sleeves.*

3. Measure the inside diameter of the sleeve with an inside micrometer or bore gauge from the top to the bottom of the sleeve where it is subject to piston and ring travel. Take the measurements at right angles to determine if the sleeve is out-of-round or excessively tapered. Refer to "SPECIFICATIONS" in Section 1, for the maximum allowable sleeve wear. If the sleeve does not meet specifications it must be discarded and a new piston sleeve installed.

4. Inspect the sleeve for scuffing or scoring and replace the sleeve (and piston) if this condition is found.

5. Check the counterbore making sure there are no burrs or fractures.

### Refacing Cylinder Sleeve Counterbore in Crankcase

6. Check the cylinder sleeve counterbore depth with a depth gauge, 1 020 560 R91, at several points around the counterbore (Fig. 27). Maximum variation between points of measurement must not exceed 0.05mm (0.002 in.). The counterbore must be refaced if it does not exceed 0.05mm (0.002 in.)

variation. Use the following counterbore tools: Driver, 1 020 553 R91, (see NOTE) Adapter, 1 020 554 R91, Holder, 1 020 557 R1 and Extension, 1 020 563 R1.

**NOTE:** *Refer to instructions furnished with counterboring tool for tool assemblies and counterboring procedures.*

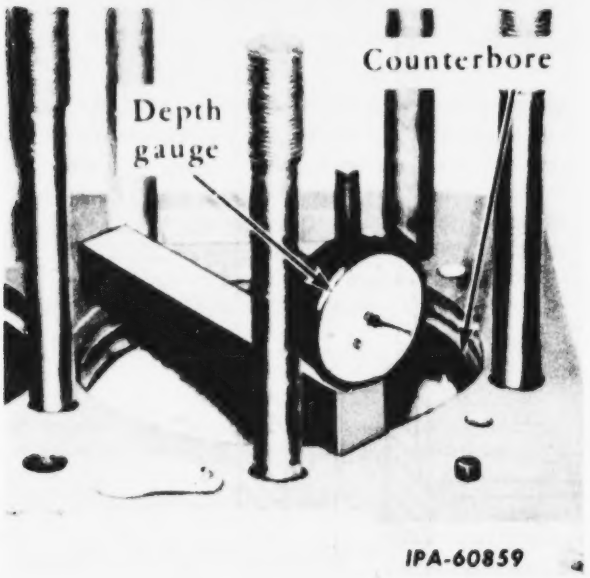



**Fig. 27. Checking Crankcase Counterbore Depth**

**Installing Sleeve Insert (Lower)**

When erosion of the crankcase at the lower cylinder sleeve sealing area takes place, the lower bore must be machined and an insert installed.

1. Refer to Fig. 28 for rework dimensions for crankcase. Surface finish to be 3.18 micrometers (125 microinch).

2. Apply Loctite Retaining Compound to crankcase and install sleeve with chamfer on O.D. towards bottom and chamfer on I.D. towards top.

3. Remove any excess retaining compound.

**Installing Sleeve Insert (Upper)**

1. Level the crankcase so that the machine spindle is perpendicular to the crankcase top deck. Locate the spindle at the center of the crankcase lower pilot bore and machine the new counterbore for the insert as specified in Fig. 29.

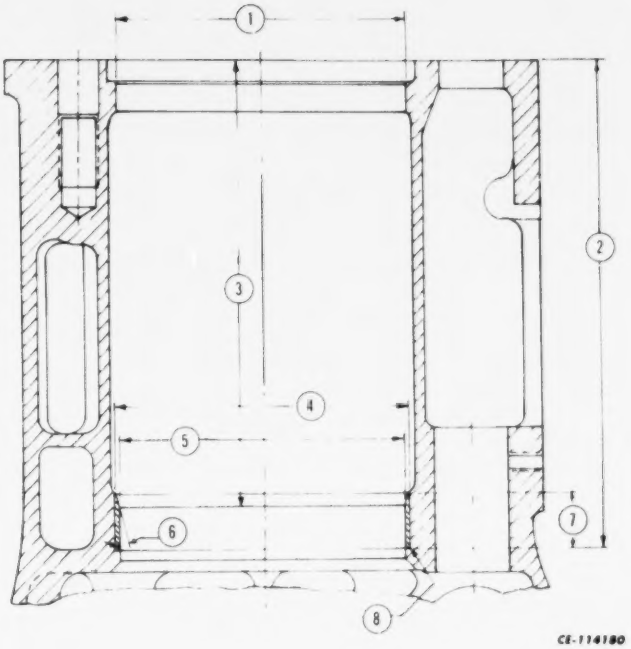



**Fig. 28. Rework for Crankcase Lower Sleeve Insert.**

1. 158.83-158.88 mm (6.253-6.255 inch) Dia. (REF) (See NOTES 1 and 2).
2. 263.53 mm (10.375 inch).
3. 239.60-240.61 mm (9.433-9.473 inch) (REF).
4. 160.35-160.38 mm (6.313-6.314 inch) Dia. (CRANKCASE) (See NOTE 1).
5. 155.58-155.63 mm (6.125-6.127 inch) Dia. (See NOTE 2).
6. 13° (REF).
7. 29.21 mm (1.150 inch) (REF).
8. 0.25 mm (0.010 inch) Max. (CRANKCASE).

**NOTE 1:** *Bores (1 and 4) must be concentric within 0.03 mm (0.001 inch) total indicator reading.*

**NOTE 2:** *Bores (1 and 5) must be concentric within 0.05 mm (0.002 inch) total indicator reading and their center lines must be square with crankshaft bearing bores within 0.08 mm (0.003 inch) in 305 mm (12 inch).*

**NOTE:** *Care must be taken to hold the counterbore seat parallel with the top deck as specified in Fig. 29.*

2. Freeze insert in dry ice for approximately one hour before installing. Apply a thin coat of "Loctite" retaining compound to the crankcase counterbore

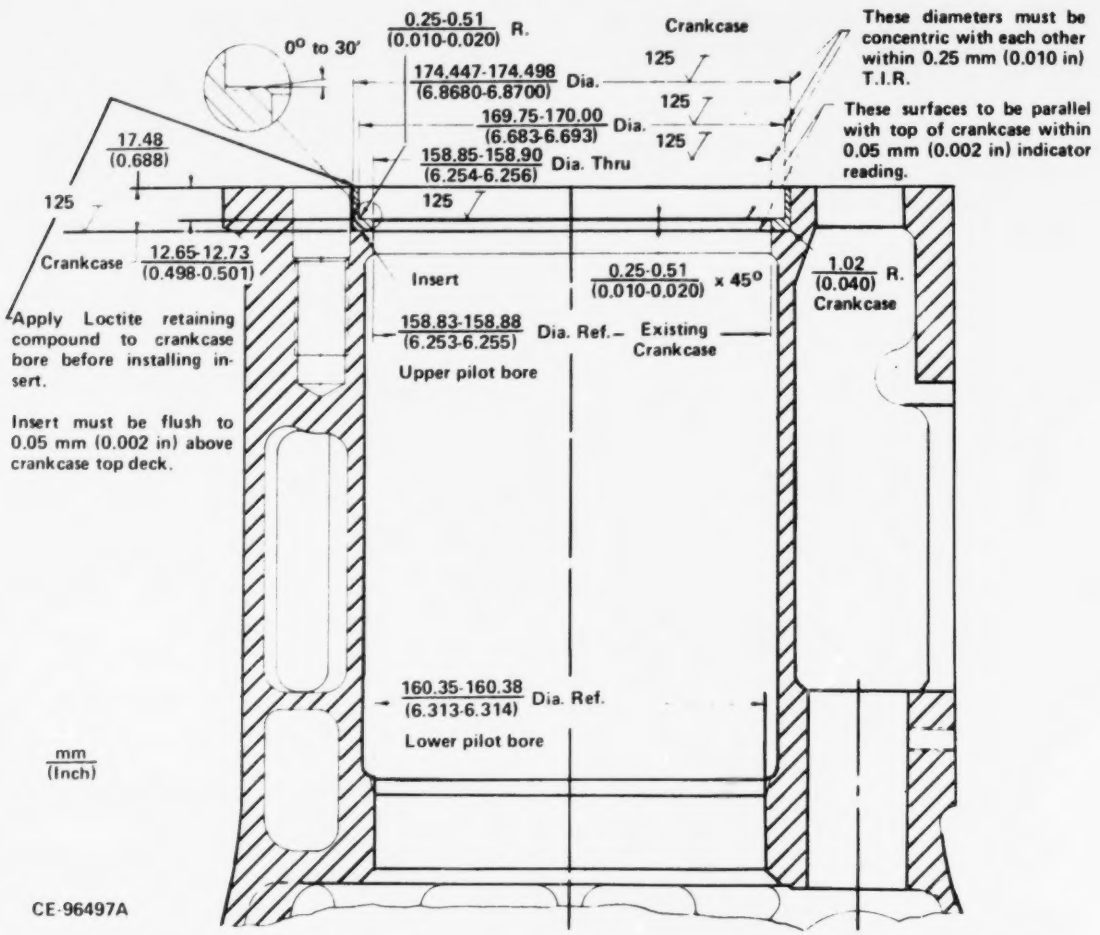

0.25-0.51 (0.010-0.020) R.
0° to 30°
Crankcase
These diameters must be concentric with each other within 0.25 mm (0.010 in) T.I.R.
174.447-174.498 (6.8680-6.8700) Dia.
125
125
169.75-170.00 (6.683-6.693) Dia.
125
These surfaces to be parallel with top of crankcase within 0.05 mm (0.002 in) indicator reading.
17.48 (0.688)
158.85-158.90 (6.254-6.256) Dia. Thru
125
125
Crankcase
12.65-12.73 (0.498-0.501)
Insert
0.25-0.51 (0.010-0.020) x 45°
1.02 (0.040) R. Crankcase
Apply Loctite retaining compound to crankcase bore before installing insert.
158.83-158.88 (6.253-6.255) Dia. Ref. – Existing Crankcase
Upper pilot bore
Insert must be flush to 0.05 mm (0.002 in) above crankcase top deck.
160.35-160.38 (6.313-6.314) Dia. Ref.
Lower pilot bore
mm (Inch)
CE-96497A

**Fig. 29. Modification of Crankcase for Installation of Crankcase Cylinder Sleeve Upper Insert**

seat and approximately two-thirds (2/3) up the bore. Install crankcase cylinder sleeve counterbore insert into the counterbore. Place a wood block across the top of the insert and tap it with a mallet to insure proper seating of the insert. The insert must be bottomed on the counterbore seat. Allow the insert to return to room temperature.

3. Machine the counterbore of the installed insert as specified in Fig. 29.

**NOTE:** *Extreme care must be taken to hold the insert counterbore seat parallel with the crankcase top deck as specified in Fig. 29.*

4. Machine the insert pilot bore as specified in Fig. 29.

5. Machine top of the insert to be flush to 0.051mm (0.002 in.) above the crankcase top deck without removing any metal from the crankcase top deck.

6. Due to possible insert protrusion above crankcase top deck, cylinder sleeve protrusion measurements must be made from the crankcase top deck and not the insert.

## 11. INSTALLATION

1. Carefully clean the top deck of the crankcase and the cylinder sleeve counterbore.

2. Check to be sure that the sealing ring grooves and the cylinder sleeve counterbore (in the crankcase) are clean and dry.

3. Coat the sealing "O" rings with vaseline and install them into the grooves in the sleeve (without twist). Be sure that the "O" ring is properly aligned in the groove

4. Coat the sealing ring contacting surface in the crankcase with vaseline. Also coat the lower end of the sleeve (approximately three inches) with vaseline.

5. Position the shims (if equipped) in the sleeve counterbore in the top of the crankcase. Install the sleeve carefully into the crankcase and press into place by hand.

6. After the sleeve has been installed, recheck to see that the sealing "O" rings are not pulled or damaged in any way. This can be done visually and by feeling around the outside of the sleeve at the bottom.

**NOTE:** *After installing a cylinder sleeve in the crankcase, check the amount of clearance between the deck of the crankcase and the top surface of the sleeve flange. This amount must not exceed the maximum dimension given in "SPECIFICATIONS" in Section 1. If sleeve protrusion is not correct, refer to Par. 7, "INSPECTION AND REPAIR" in Section 2.*

7. Install the pistons and connecting rods. (Refer to Par. 6.)

8. Install the cylinder heads. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES.")

## 12. ENGINE RUN-IN SCHEDULE

After the installation of new sleeve and piston sets or piston rings, the engine must be "run-in" according to the following conditioning schedule, before operating at normal load and speed.

1. Check and fill the cooling system.

2. Fill the crankcase with lubricating oil as specified in the Operator's Manual.

3. If the engine was placed on its side during any inspection, repair or replacement, the lubricating oil pump must be primed as described in Section 7, "LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS."

**NOTE:** *Do not run the engine at low idle speeds for long periods after installing new rings or sleeves, as rings will not seat during idle operation.*

**Dynamometer Run-In Procedure**

4. Install the necessary diagnostic instruments as outlined in "DIAGNOSTIC MANUAL," ISS-1526.

5. Operate engine at no load @ 550-600 rpm and check for leaks in water, lube oil, fuel and air induction systems; *time required: 5 minutes.*

6. Operate engine at 3/4 rated speed and 1/2 rated load (approximate) for that speed, *time required: 5 to 10 minutes.*

7. Operate engine at "Rated Horsepower and Rated Speed" (rpm). (Refer to Guideline Data in "DIAGNOSTIC MANUAL," ISS-1526 for data; *time required: 35 to 40 minutes.*

8. Recheck for oil, air and water leaks, retighten cylinder head bolts and adjust the valve lash. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES," for proper torquing sequence.) Inspect and replace the oil filters if necessary.

9. It is not necessary to change oil filter after the above run-in schedule. The same oil may be used until the next regular change period.

**In Vehicle Run-In Procedure**

10. Install the necessary diagnostic instruments as outlined in "DIAGNOSTIC MANUAL," ISS-1526.

11. Operate engine at "No Load" @ 550-600 rpm to check for leaks in water, lube oil, fuel and air induction systems; *time required: 5 minutes maximum.*

12. Operate vehicle at 3/4 rated speed (rpm) and 1/2 load for that speed; *time required: 5 to 10 minutes maximum.*

13. Operate vehicle at full load and rated speed (refer to Guideline Data in "DIAGNOSTIC MANUAL ISS-1526 for data) while maintaining normal operating temperature of engine and torque converter; *time required: 35 to 40 minutes.*

14. Recheck for oil, air and water leaks, retighten cylinder head stud nuts and adjust valve lash. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES," for proper torquing sequence.) Inspect and replace the oil filter elements if necessary.

15. Continue to operate engine for a period of 30 minutes to complete a total of one hour and 15 minutes using the diagnostic procedures outlined in "DIAGNOSTIC MANUAL," ISS-1526.

**NOTE:** *Do not exceed 15 minutes per each stall check.*

16. It is not necessary to change oil after the above run-in schedule. The same oil may be used until the next regular change period.

### 13. PRIMING LUBRICATING SYSTEM

**NOTE:** *Diesel engines must not be rotated when priming with oil, otherwise they are likely to start running.*

When assembling the overhauled engine, it is necessary to thoroughly lubricate the various running parts with clean engine oil to assure initial lubrication when engine is first started. However, to further make certain that complete initial lubrication is available, the engine lubricating system should be pressure primed or charged with oil. The Oil Leak Detector SE-1632, can be used for this purpose. Attach the line from the oil leak detector to a suitable fitting located in the main oil gallery of the engine and inject sufficient oil into the engine to fill the oil filters and charge the entire system. Use only clean engine oil of the same grade to be used for engine break-in. New or overhauled engines that have been in storage over an extended period should also be primed in a similar manner.

When the priming procedure is used, make certain that the oil level is checked before the engine is put into service. Do not over-fill the engine, neither should the engine be short of oil as a result of using the pressure priming procedure.

Priming the engine will minimize the possibility of scuffing or heat build-up in the running components which could lead to immediate or low mileage failures.

## CRANKSHAFT AND MAIN BEARINGS

### 1. DESCRIPTION

The crankshaft is fully counterbalanced and the journals are induction hardened.

The crankshaft supports the connecting rods and pistons along its length. Located at the forward end is the crankshaft drive gear which supplies the drive for the camshaft, injection pump, lubricating oil and water pump, fan drive housing and on tractors only, for the hydraulic pump, by means of the timing gear train. The flywheel is mounted to the rear end of the crankshaft. Two seals, one at the front and one at the rear, prevent leakage of engine lubricating oil around the ends of the crankshaft.

Bearing caps are furnished with the crankcase, and these support the crankshaft in true alignment. Webs integral with the crankcase provide the upper half of the main bearing supports, and removable caps provide the lower support. The caps are held in place with cap screws. The bearing caps are not interchangeable, and each has a number stamped upon it which signifies its correct location in the crankcase. No. 1 is at the front of the engine.

**NOTE:** *Extreme care must be taken to guarantee cleanliness of the crankcase, crankshaft, and bearing after service has been completed. Whenever possible, the crankshaft would be removed when new bearings are being installed in order to clean the crankcase thoroughly. All bearing surfaces must be free of grit and burrs. Small particles of dust and dirt left between the crankshaft and bearings will cause rapid wear and scoring of the crankshaft journal and insert. Any foreign material left between the bearings and the crankcase and bearing caps will cause distortion of the bearing and a reduction in operating bearing clearance at that point. The frictional heat thus produced will in turn cause the bearing material to melt away from the steel back of the bearing at that point. Such melted material will create further hot spots until complete bearing failures take place. Anything that interferes with the operating clearance of any bearing, or proper heat dissipation has its affect upon bearing life. Cleanliness cannot be overstressed.*

The bearing inserts are of the precision type. The words "UPPER" and "LOWER" are stamped on the back of the bearings for identification purpose. The bearings are inserted between the crankshaft and the crankcase, and between the crankshaft and the bearing caps. The rear main bearing is the thrust bearing, and it has thrust flanges.

### 2. REMOVAL

**Crankshaft Bearings**

1. Drain the oil from the crankcase oil pan. Remove the cap screw securing the scavenging oil pump manifold (if equipped) to the scavenging pump. Remove the oil pan with scavenging pump manifold attached. Remove the oil suction pipe that is attached to the crankcase.

2. Remove the piston cooling jets from the right side of the crankcase. (Refer to Par. 2 in Section 3, "CONNECTING RODS, PISTONS, RINGS AND SLEEVES.")

2A. Remove the gear oil jet tube from the crankcase (Fig. 1).

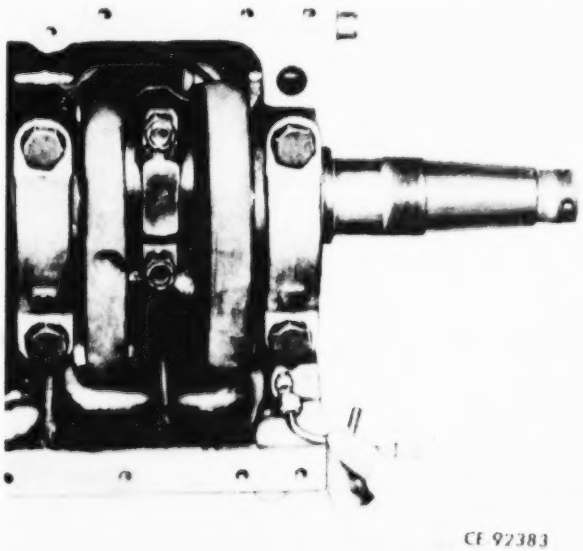



**Fig. 1. Removing Gear Oil Jet Tube**

3. Remove the cap screws securing the crankshaft bearing caps. Tap the caps lightly with a soft metal hammer or mallet to loosen them. If the bearings are to be reused, be certain that they are identified as to their original positions. Remove the lower bearing from the caps. Wrap the pieces in a clean cloth and store until reassembly.

**NOTE:** *If the crankshaft is to be removed, disregard Step 4.*

# CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL

4. Remove the upper bearing halves from between the crankshaft and the crankcase with a thin piece of flexible soft metal. This will push against the end of the bearing farthest from the nib holding the bearing in the crankcase support and at the same time turning the crankshaft in the direction of rotation. The bearing will slide easily from position (Fig. 2).

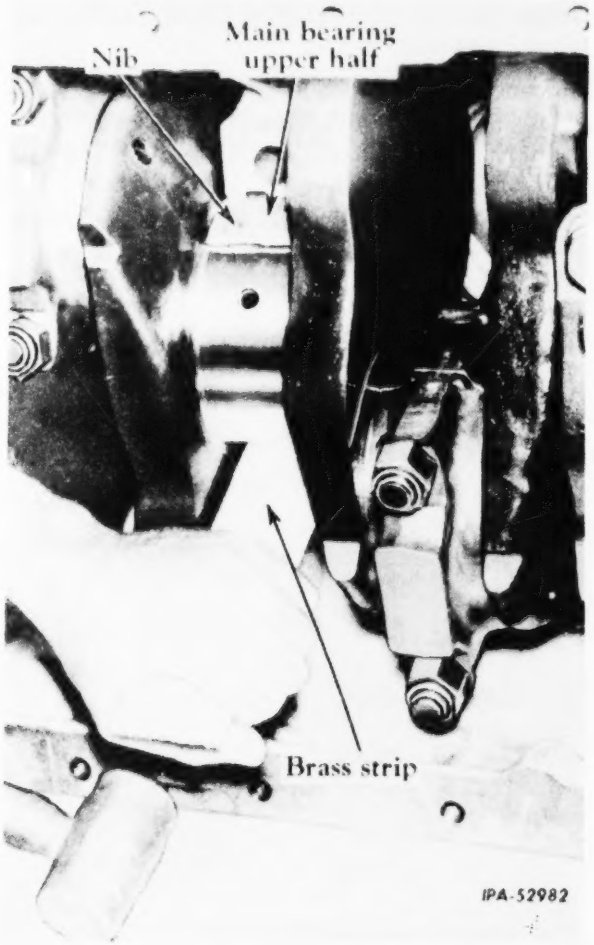



**Fig. 2. Removing the Upper Half of the Crankshaft Bearing**

An alternate method of removing the upper halves of the bearings is to hammer the closed end of a small cotter pin to form a "T" and then insert the prongs of the cotter pin into the oil hole of the crankshaft journal with the flattened head just protruding. Rotate the crankshaft, and the cotter pin head will push the bearing from position.

**Crankshaft**

5. Remove the flywheel. (Refer to "FLYWHEEL" in this section.)

6. Remove the flywheel housing from the crankcase.

**NOTE:** *It is not necessary to remove the flywheel housing if all that is required is to replace the crankshaft rear oil seal. Refer to Par. 4, "INSTALLATION" for rear oil seal replacement directions.*

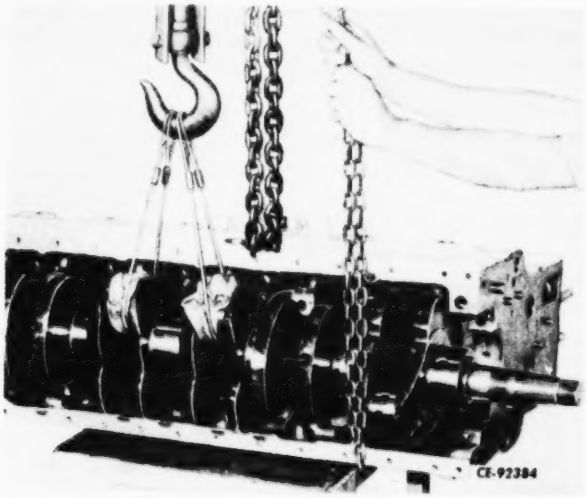



**Fig. 3. Removing Crankshaft**

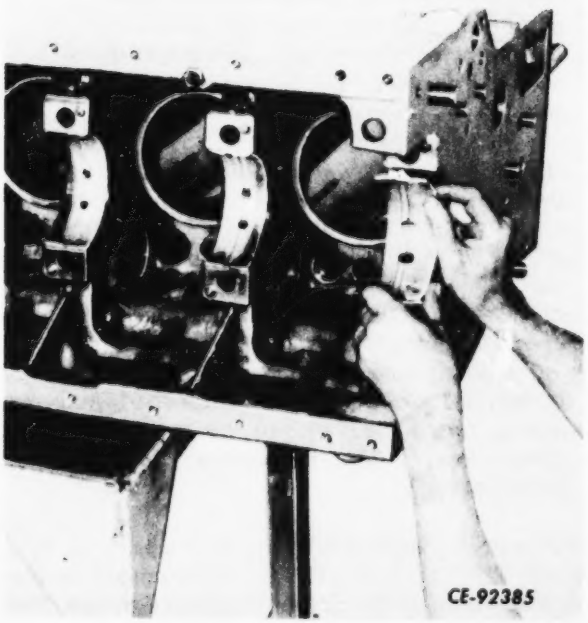



**Fig. 4. Removing Upper Main Bearing Halves**

7. Remove the crankcase front cover assembly. (Refer to Section 5, "TIMING GEAR TRAIN, FRONT COVER AND CAMSHAFT.")

8. Remove the connecting rod bearing caps and push the assemblies to the top of their travel.

9. Lift the crankshaft out of the crankcase (Fig. 3). Remove the upper main bearing halves (Fig. 4).

10. Whenever the rubber radial lip type rear oil seal is installed (in the seal retainer) the seal wear sleeve on the crankshaft flange must be replaced. Use a cape chisel or similar tool to remove the wear sleeve. Be careful not to mar or scratch the crankshaft surface.

11. Remove the rear oil seal retainer and rubber lip type seal from the flywheel housing. Tap the rubber lip oil seal from the retainer.

### 3. INSPECTION AND REPAIR

**NOTE:** *Crankshaft must not be straightened.*

1. Clean all parts with cleaning solvent, dry with compressed air, and inspect the bearings for wear and evidence uneven bearing support. If such evidence is present, examine the bearing caps and supporting surfaces of the crankcase for high spots and burrs.

2. Hardness must be checked on every journal which incurred a bearing failure, shows evidence of overheating or before grinding crankshaft. Using a Rockwell Hardness Tester, check in at least three locations as close to fillet as possible. Also, check rod journals at top, bottom and one other location (top and bottom determined with journal at TDC). Minimum hardness for non-fillet hardened shafts is 30 Rc. These shafts have an identification number, 277 100 R1 or R2, forged into the center cheek. Fillet hardened shafts, forged number 670 331 C1, must have a minimum hardness of 45 Rc. If any reading is below this, the shaft must be scrapped.

3. Inspect the crankshaft journals for scoring, and measure the diameter of each journal, using a micrometer (Fig. 5). Check the dimensions obtained against those specified in "SPECIFICATIONS") in Section 1. Measure each journal at two points, one at right angles to the other, in order to show any tendency of out-of-round. Move the micrometer over the entire width of the journal.

4. Inspect the crankshaft gear teeth for wear and chipping. If it is necessary to replace it, pull the gear from position.

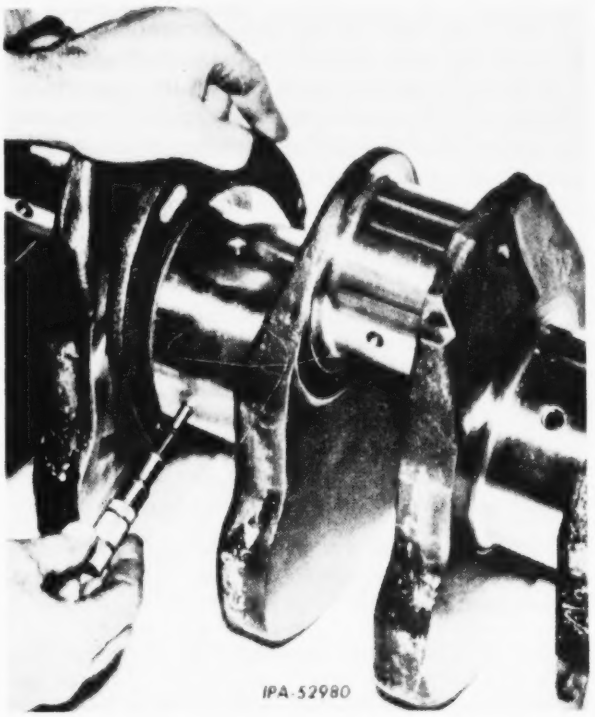



**Fig. 5. Measuring the Crankshaft Journals**

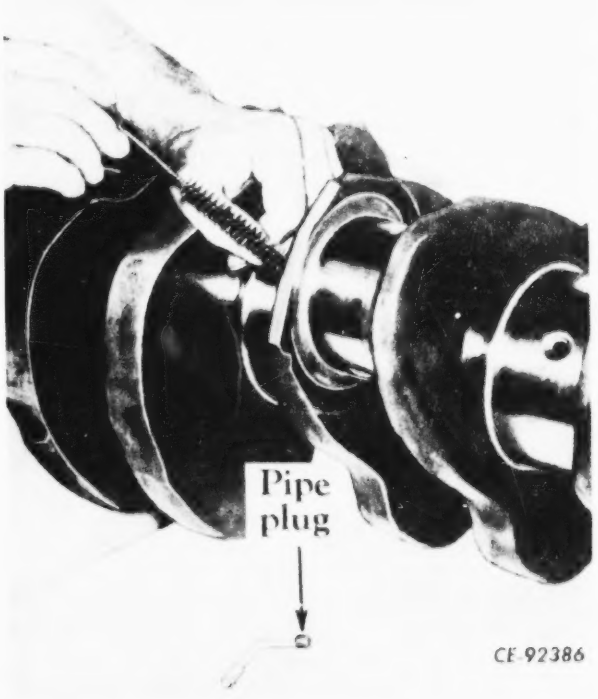



**Fig. 6. Cleaning Crankshaft Oil Passages**

# CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL

5. Clean all the crankshaft internal oil passages of any dirt or sludge that may have accumulated. With the six plugs removed from the crankshaft, run a stiff wire brush (seven inches or longer) through the oil passages to loosen the deposits (Fig. 6). Then wash the passages and external surfaces of the crankshaft thoroughly with solvent. Blow the passages and external surfaces dry with compressed air.

A visual inspection of the drilled holes in the main and connecting rod journals must be made to assure all passages are open. Reinstall the six plugs securely in the crankshaft.

6. Inspect the crankcase for sludge deposits, especially in the corners. The crankcase must be thoroughly cleaned and inspected. Remove the oil gallery plugs and flush out the passages in the crankcase with fuel oil. Install the plugs.

7. Replace the front and rear seals with new. Refer to Par. 4, "INSTALLATION," for rear oil seal replacement details.

8. Remove and clean the crankcase breather element. The element is located in the mounting flange of the breather pipe which is secured to the right hand (rear) side of the crankcase.

9. Inspect the oil pan and clean thoroughly.

## 4. CRANKSHAFT BEARING CAPS

Crankshaft main bearing caps are rough machined and line reamed while fitted to the crankcase. This results in each cap being fitted only for its respective position. Therefore, a main bearing cap cannot be furnished as a regular service part due to the need for line reaming to fit the particular bore where it is intended to mate.

Accidents do occur occasionally and, in many cases, it is undesirable to scrap a crankcase if only the bearing cap needs replacement. A main bearing cap that is machined in the rough for such emergency cases is available, and can be obtained as specified in the parts catalog. However, it is necessary to have facilities available to line ream the bore for the finishing operation.

### DIMENSIONS OF MAIN BEARING BORE IN CRANKCASE

| | |
|---|---|
| Line ream final to..... | 123.04-123.06mm (4.844-4.845 in) |

## 5. INSTALLATION

1. Wipe the bearing supports of the crankcase free of oil with a lint-free clean cloth. The crankcase must be bottom side up and supported level with blocks.

2. Install the upper halves of the bearings (bearings with oil hole in center) to the crankcase. If the original bearings are being reinstalled, be sure that they go to the positions from which they came. The nibs of the bearings must fit into the notches in the crankcase bearing supports (Fig. 7).

3. Install the crankshaft in place (See NOTE).

**NOTE:** *When a new crankshaft is being installed, first remove the Nox-Rust protective coating completely from the exterior and all drilled oil passages of crankshaft. A solvent must be used to assure complete removal of the preservative. To clean the oil passages, use a stiff fiber bristle brush to assure removal of all Nox-Rust. After cleaning, install the pipe plugs, received with this crankshaft, into the tapped holes in the cheeks of the crankshaft throws.*

4. Install the lower main bearings and bearing caps. Lubricate bolts with clean engine oil and tighten in steps, first to 238 N·m (175 ft-lbs), then to 320 N·m (235 ft-lbs) torque.

**NOTE:** *The number that is stamped on each main bearing cap (to identify its location) must be toward the camshaft side of the crankcase when installed.*

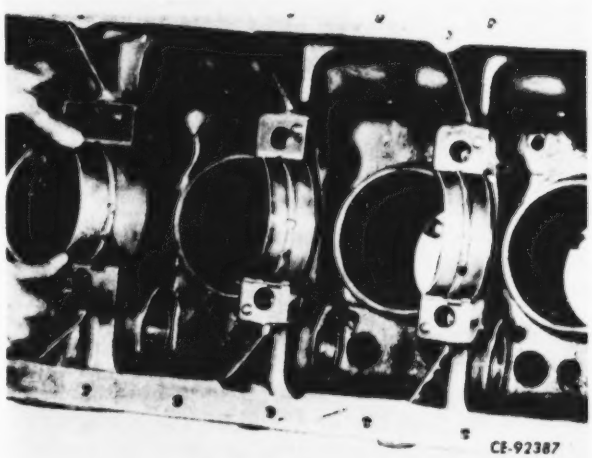



**Fig. 7. Installing Upper Halves of Main Bearings**

5. Pull the connecting rods down onto the crankshaft. Be sure that the bearings are in place. Coat the threads of the connecting rod bolts with clean engine oil. Install the connecting rod bearings and bearing caps, being sure that the correct cap is located on its rod and that the identifying numbers are on the same side. Oil the bearings with clean engine oil. Tighten the connecting rod bolt nuts in steps, first to 152 N·m (112 ft-lbs) then to 203 N·m (150 ft-lbs) torque.

**Fitting Main Bearings**

**NOTE:** *For general information on fitting bearings (includes bearing "crush" specifications), refer to "BEARING FITTING PROCEDURE" in Section 3.*

6. Fit the main bearings as follows:

**NOTE:** *Do not turn the crankshaft while the following procedure is being performed.*

a. Remove the center main bearing cap and the lower bearing.

b. If virgin lead wire is to be used to check the bearing clearance, wipe clean and oil the crankshaft journal. If Plastigage is to be used, wipe the bearing surface and the exposed half of the crankshaft journal free of oil as the plastic material is soluble in oil.

c. Place a suitable length of 0.25mm (0.010 in) virgin lead wire or a piece of Plastigage across the bearing surface (Fig. 8) and install the bearing and cap.

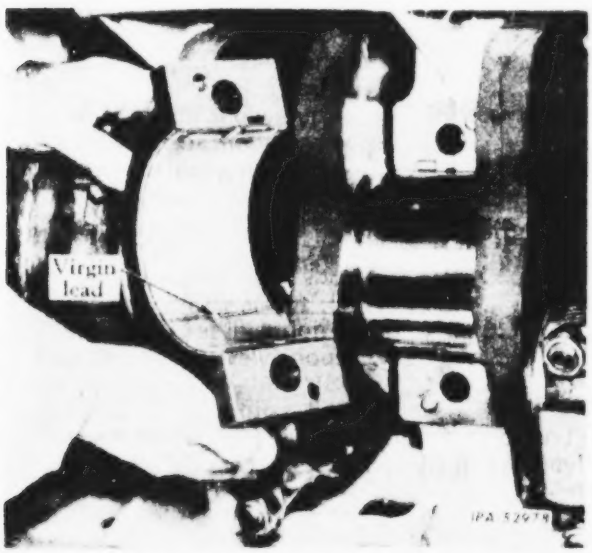



**Fig. 8. Checking Main Bearing Running Clearance**

d. Tighten the cap screws to 320 N.m (235 ft-lbs). Remove the bearing cap. If virgin lead was used carefully remove the wire, which will have been crushed to the amount of clearance present. Measure the wire, using a micrometer. If Plastigage was used, the flattened plastic material will be found adhering to either the bearing or the crankshaft. DO NOT REMOVE THE PLASTIGAGE. To determine the bearing clearance, compare the width of the flattened plastic material at its widest point with the graduations on the envelope.

e. If the crankshaft, bearings and crankcase are in good condition, the measurement taken should fall within the specified clearance given in "SPECIFICATIONS" in Section 1. Should the clearance obtained be more or less than the specified amount, replace with a new bearing. Should the clearance remain excessive, grind the crankshaft (See NOTE) and install undersize bearings for the ground crankshaft. Bearings are available in 0.25mm (0.010 in), and 0.76mm (0.030 in) undersize. Fig. 10 shows the dimensions to which the crankshaft journals may be ground. Do not grind beyond the maximum limit shown.

**NOTE:** *Crankshaft must be hardness checked before regrinding. Refer to Par. 3 "Inspection and Repair" for procedure.*

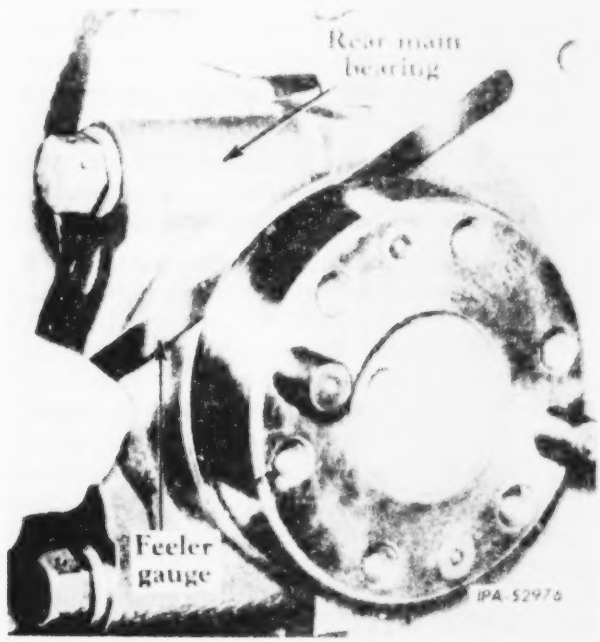



**Fig. 9. Checking Crankshaft End Clearance**

# CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL

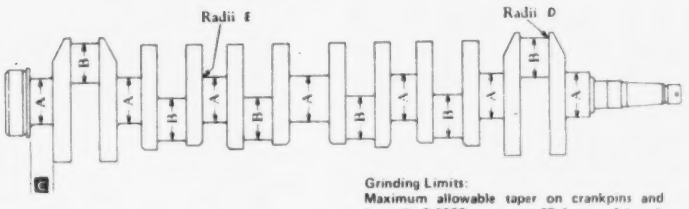

Radii E
Radii D
A
B
C
Grinding Limits:
Maximum allowable taper on crankpins and journals 0.0038 mm per 25.4 mm of length (0.00015 in per 1.0 in. of length). Crankpins and journals must be polished, and must not be over 0.013 mm (0.0005 in) out-of-round.
IPA-56154C

**Fig. 10. Dimensions to which Crankshaft may be Ground**

| Size | Main Bearing Dia. "A" mm (in) | Connecting Rod Bearing Dia. "B" mm (in) | Rear Main Bearing Width "C" mm (in) | All Crank Pin Bearings "D" mm (in) | All Main Bearings "E" mm (in) |
|---|---|---|---|---|---|
| Standard | 114.274 to 114.300 (4.4990 to 4.5000) | 88.811 to 88.837 (3.4965 to 3.4975) | 66.90 to 66.98 (2.634 to 2.637) | 4.70 to 5.08 (0.185 to 0.200) | 4.06 to 4.44 (0.160 to 0.175) |
| 0.010 in Under | 114.020 to 114.046 (4.4890 to 4.4900) | 88.557 to 88.583 (3.4865 to 3.4875) | 66.90 to 66.98 (2.634 to 2.637) | 4.70 to 5.08 (0.185 to 0.200) | 4.06 to 4.44 (0.160 to 0.175) |
| 0.030 in Under | 113.512 to 113.538 (4.4690 to 4.4700) | 88.049 to 88.075 (3.4665 to 3.4675) | 67.21 to 67.29* (2.646 to 2.649) | 4.70 to 5.08 (0.185 to 0.200) | 4.06 to 4.44 (0.160 to 0.175) |
| *Grind an equal amount of material off at each thrust face to maintain the proper end play. | | | | | |

f. If the results obtained were within the specified amount, remove the Plastigage, add clean engine oil to the bearing, and install the center main bearing cap. Torque the cap screws to the amount specified.

7. Continue checking the other main bearings in the same manner. Check the rear main next, followed by the front main and then the intermediates

8. Check the end thrust present in the crankshaft by inserting a feeler gauge equal to the amount specified in "SPECIFICATIONS" in Section 1, and as shown in Fig. 9. Should the clearance present be less than the amount specified, remove the rear main bearing and rub off material evenly from the flange surface. Should the clearance be more than specified, replace the rear main bearing with a new one.

9. Recheck the connecting rod end play as outlined in Section 3, "CONNECTING RODS, PISTONS, RINGS AND SLEEVES."

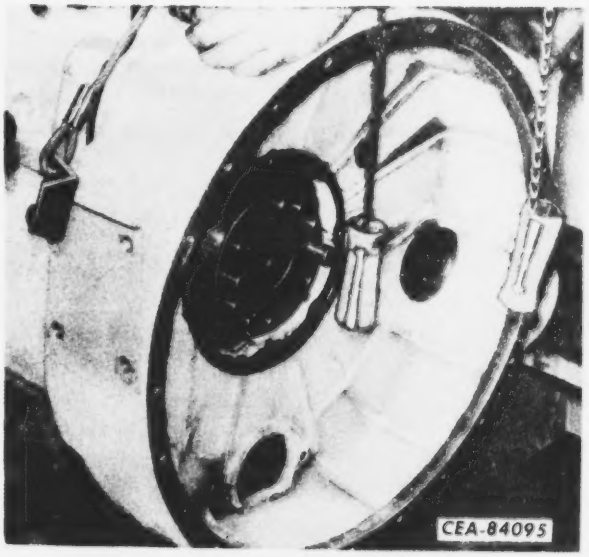



**Fig. 11. Installing the Flywheel Housing**

10. Clean the rear face of the crankcase and the flywheel housing. Apply a thin film of non-hardening sealer to both surfaces and install a new gasket. Install the flywheel housing and secure with cap screws, Fig. 11.

**Rear Oil Seal Replacement**

When the oil seal in the flywheel or adapter housing is changed the oil seal bore should be checked for a chamfer. If no chamfer is found use a file to break the edge of the bore. This should be done to prevent possible damage to the oil seal casing during installation.

**CAUTION! Care should be taken not to damage the bore while filing the chamfer edge.**

Prior to installing the seal and wear sleeve, clean the bore and crankshaft of all foreign material.

11. Install a new crankshaft rear oil seal as follows:

**NOTE:** *If the rear oil seal is being installed as part of the crankshaft installation disregard the following steps (a) to (d) inclusive as they were performed as part of the crankshaft removal procedure.*

a. Remove the flywheel from the crankshaft. Refer to "FLYWHEEL" in this section.

b. Remove the eight cap screws securing the oil seal retainer to the flywheel housing.

c. Pry the seal retainer (if equipped) and gasket from the flywheel housing. Remove the oil seal unit from the end of crankshaft. Tap the oil seal from the seal retainer. Remove the WEAR SLEEVE from the crankshaft flange using a muffler chisel (Mac Tool No. MC-22 or equivalent) being extremely careful not to scratch or mar the surface of the crankshaft flange.

d. Inspect the flywheel housing surface in area to which seal face plate or retainer is installed. Remove any burrs with a stone and be sure the entire surface is clean. Tough up the outside diameter of the crankshaft flange chamfer with a stone to remove roughness or nicks.

12. Determine the three evenly spaced tapped holes in the crankshaft flange that will be used for the driver tool bolts to install the seal and wear sleeve. One of the tapped holes in the flange is off-set 1/8 inch from equal spacing and must not be used for installing the seal and wear sleeve.

13. Install a new crankshaft seal and wear sleeve as follows.

a. If oil seal and wear sleeve are not unitized (pre-assembled), assemble seal to sleeve before installing onto crankshaft as follows:

1. Seal must be clean and lubricated. Coat single lip seal with Grade 251H-EP grease or clean engine oil. Double lip seal must have cavity between lips filled with Grade 251H-EP grease.

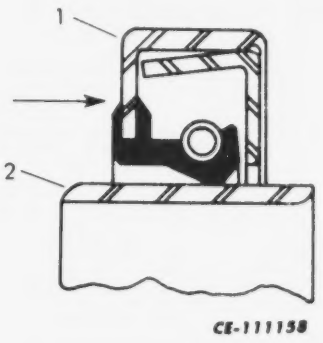



**Fig. 12. Assembling Seal to Sleeve**

1. Seal (single lip)
2. Chamfer on O.D. of sleeve

**UNITIZED OIL SEAL AND WEAR SLEEVE DIMENSION CHART**

| Seal and Sleeve Location | Dim. "A"—Sleeve Installed (Fig. 13) | Dim. "B"—Seal Installed (Fig. 13) |
|---|---|---|
| Single or Double Lip in Housing or Retainer on Crankshaft | 12.34mm (0.486 in) | 17.27mm (0.680 in) |

2. Assemble seal onto sleeve as shown in Fig. 12 by pushing the seal in direction of arrow (See NOTE).

**NOTE:** *Seal must be installed onto side of sleeve with chamfer on OD (2, Fig. 12) to avoid damage to seal lip.*

b. If the unit is equipped with a crankshaft rear oil seal retainer, assemble the retainer to the flywheel housing making sure it is centered to the crankshaft by using the centering tool, 1 020 471 R1 (part of old installing tool PLT-513-7) and bolt to the flywheel housing. Tighten Nylok cap screws to 27 N·m (20 lbf-ft) torque.

c. Install the flywheel housing if it was removed.

NOTE: *Seal bore in retainer must be concentric with crankshaft within 0.025 mm (0.010 in) full indicator measure as shaft is rotated 360°.*

d. Coat the inside diameter of the wear sleeve and outside diameter of the seal with a thin film of R.T.V. liquid gasket (Dow 732, General Electric 1473 or equivalent). Care should be taken not to get any of this liquid on the seal lip or the OD of the wear sleeve.

NOTE: *At no time should the seal be removed from the sleeve during assembly.*

e. Bolt crankshaft attaching adapter plate to the crankshaft.

f. Place unitized seal assembly onto the adapter plate. Radius on the OD of wear sleeve to be located toward the rear as shown in Fig. 13.

g. Place unitized seal assembly installing adapter on the crankshaft adapter plate (see NOTE).

NOTE: *Two spacers are included with this tool and are to be used when installing double lip seal assemblies in the retainer on the P.T.O. gear along with two longer capscrews.*

h. Place hydraulic cam (OTC-Y-15A or equivalent) on the adapter plate and secure with the washer and nut. Install the seal and sleeve onto the shaft into housing or retainer as one assembly to dimension "A" and "B" per OIL SEAL AND WEAR SLEEVE DIMENSION CHART.

**NOTE:** *Seal face must be parallel with rear of crankshaft within 0.25mm (0.010 in).*

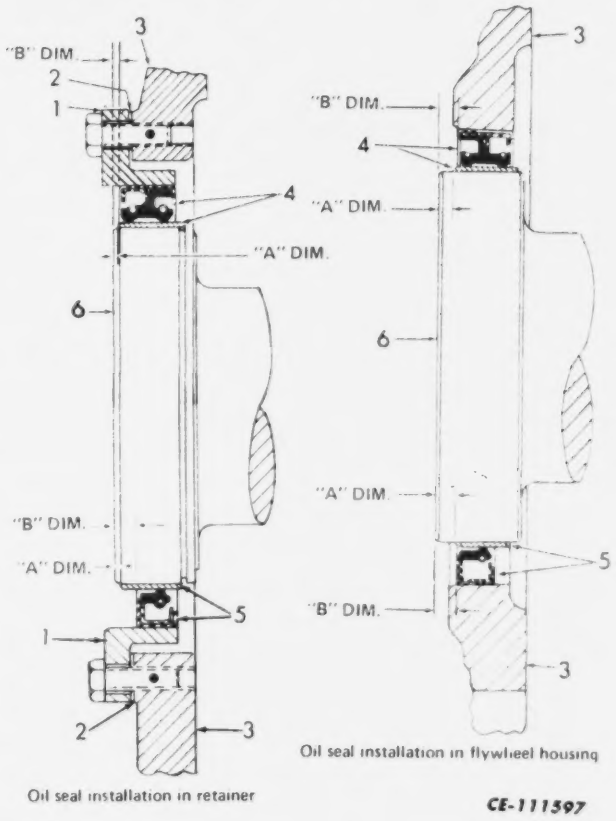



**Fig. 13. Oil Seal and Wear Sleeve Installation Diagram**

1. Retainer
2. Gasket
3. Housing
4. Double Lip Seal and Sleeve
5. Single Lip Seal and Sleeve
6. Rear Face of Crankshaft

14. Install the flywheel. (Refer to "FLYWHEEL" in this section.)

15. Install the crankcase front cover. (Refer to Section 5, "TIMING GEAR TRAIN, FRONT COVER AND CAMSHAFT.") Be sure that the timing marks on the camshaft gear and crankshaft gear are lined up.

16. Install the piston cooling jets. (Refer to Par. 2 in Section 3, "CONNECTING RODS, PISTONS, RINGS AND SLEEVES.")

17. Install the oil suction pipe to the crankcase. Use a new gasket where the pipe attaches to the front cover. Install the crankcase oil pan and scavenging oil pump manifold. Be sure that the manifold "O" rings are in place. Install and tighten the oil pan drain plugs to 47 N.m (35 ft-lbs) torque.

18. Fill the crankcase with lubricating oil as specified in the Operator's Manual.

19. The lubricating oil pump must be primed as described in Section 7, "LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS."

20. Check the water in the cooling system and start the engine. Observe the engine oil pressure and the engine operating temperature. Run the engine under light load for a period of five hours.

## FLYWHEEL

### 6. DESCRIPTION

The flywheel is secured to the end of the crankshaft with bolts and hardened washers. Dowels are provided to pilot the flywheel to the crankshaft flange. The cranking motor drive ring gear is a shrink fit and is replaceable.

### 7. REMOVAL

1. Remove the engine clutch (if equipped). (For engine clutch removal procedure, refer to the Chassis Manual for the specific machine.)

2. Remove the flywheel bolts with washers.

3. Insert two jack screws into the tapped puller holes in the flywheel. Also install two guide pins.

4. Tighten the jack screws evenly until the flywheel is pulled free of the dowel pins on the crankshaft (Fig. 14).

5. Attach a hoist to the flywheel. Lift the flywheel and slide it off the guide pins.

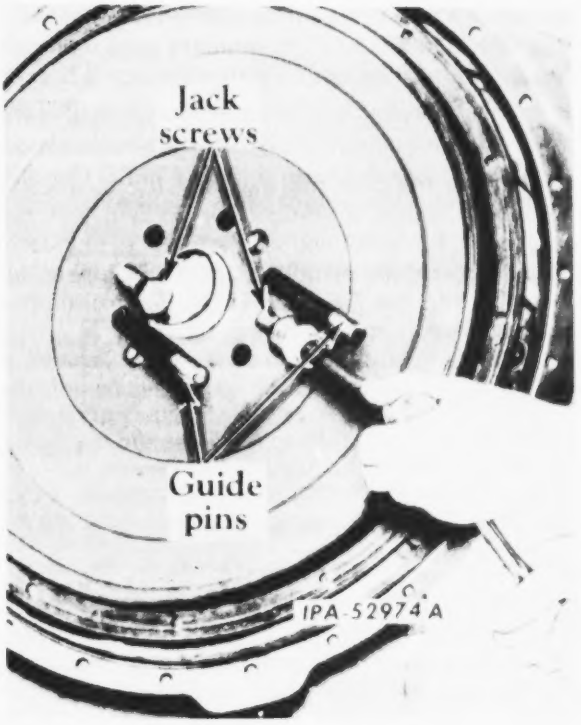



**Fig. 14. Removing Flywheel**

### 8. INSPECTION AND REPAIR

1. Wash the flywheel and ring gear in drycleaning solvent.

2. Inspect the clutch driven disc friction face on the flywheel for heat checks and scoring. If it is not in serviceable condition, replace the flywheel.

When the heat check score marks or grooving is considered excessive, the flywheel must be refaced. The maximum allowable stock that can be removed during the life of the flywheel is 1.52mm (0.060 in).

Removal of more surface material than specified above may weaken the flywheel or result in interference of the driven disc hub with the clutch pilot bearing on the crankshaft bolt heads.

3. Inspect the cranking motor gear for broken or milled teeth, and replace if necessary.

4. Remove the ring gear from the flywheel by heating it with a torch to expand it, following that operation by driving it from the flywheel. Make sure direct heat is not applied or excessive heat is not transferred to the flywheel.

# CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL

5. Install a new ring gear by first heating the gear to 260-288° C (500-550° F) to expand it, and then placing it onto the flywheel while the ring gear is hot. The chamfered edge of the ring gear inside diameter must be next to the shoulder on the flywheel.

6. Remove the pilot bearing from the flywheel (if equipped). Clean the bearing in solvent and then inspect it for wear and damage. If in serviceable condition, repack with IH 251H EP grease, and install it into the flywheel. If the bearing is not in good condition, it must be replaced.

## 9. INSTALLATION

**NOTE:** *Before installing flywheel, the flywheel housing should be checked as follows.*

### CHECKING FLYWHEEL HOUSING FACE RUN-OUT

To check the run-out of the flywheel housing, attach a dial indicator to the crankshaft flange placing the indicator pointer against the flywheel housing flange. Remove crankshaft "end-play" and note reading. Check at four points 90 degrees apart for total face variation. Keep crankshaft "end-play"at zero in the same direction for all readings (Refer to Fig. 15). For allowable housing face run-out tolerance refer to "SPECIFICATIONS," in Section 1.

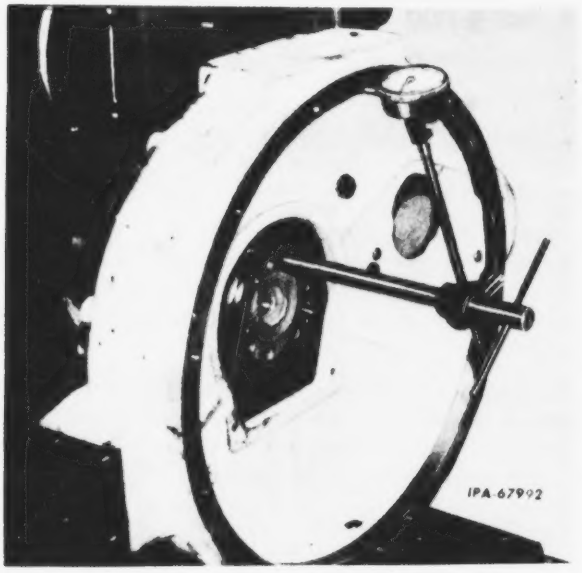



**Fig. 15. Checking Run-Out of Flywheel Housing Face in Relation to the Axis of the Crankshaft**

### CHECKING FLYWHEEL HOUSING BORE ECCENTRICITY

To check the eccentricity of the flywheel bore relative to the crankshaft axis, attach a dial indicator to the crankshaft placing the indicator pointer against the flywheel housing bore as shown in Fig. 16. Rotate the crankshaft slowly and note total indicator reading variation. For allowable housing bore eccentricity tolerance refer to "SPECIFICATIONS," Section 1.

1. Place the flywheel in position on the guide pins, so that the bolt and dowel pin holes line up.

2. Using four flywheel bolts and hardened washers draw the flywheel to crankshaft flange evenly.

3. Remove the guide pins. Install the remaining two flywheel bolts and hardened washers. Torque the bolts to 305 N.m (225 ft-lbs).

4. Install and lubricate the clutch pilot bearing (if equipped).

5. Install the clutch (if equipped). (Refer to the chassis manual for the specific machine for clutch installation procedure.)

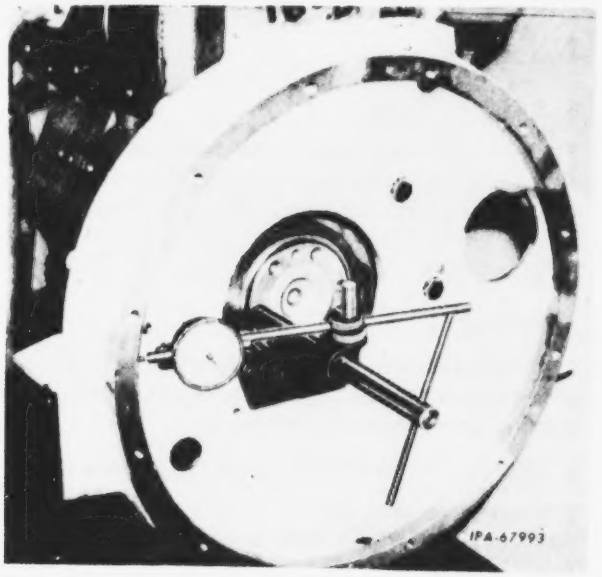



**Fig. 16. Checking the Eccentricity of the Flywheel Housing Bore in Relation to the Axis of the Crankshaft**

## TIMING GEAR TRAIN AND FRONT COVER

### 1. DESCRIPTION (Refer to Fig. 1)

The timing gear train is accessible when the crankcase front cover is off. All the gears are driven by the crankshaft gear (6). The gears provide a positive and accurate drive to camshaft, lubricating oil and water pump, injection pump, fan drive and hydraulic pump (when used). The only timing marks in the gear train are between the crankshaft, camshaft and injection pump gears as shown in Fig. 6. The injection pump is timed to the engine through the injection pump adapter. (Refer to Section 9, "INJECTION PUMP ADAPTER" for detailed information on injection pump timing.) Two lubricating oil jets (5 and 9) provide lubrication for all of the gears.

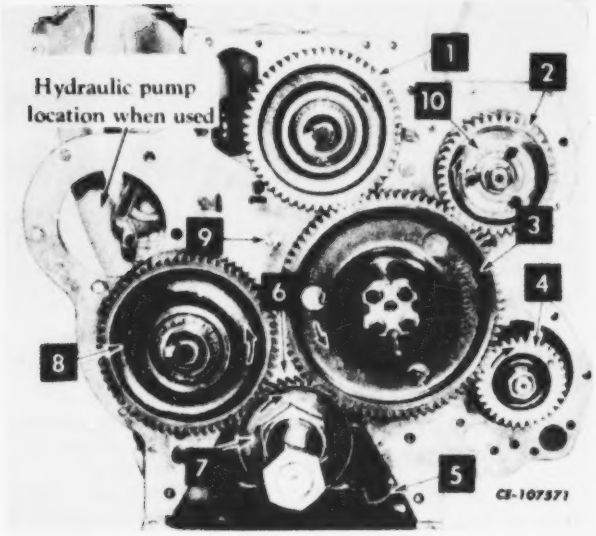



**Fig. 1. Gear Train**

1. Fan Idler Gear (Used only when fan is required).
2. Injection Pump Drive Gear.
3. Camshaft Gear
4. Lube Oil and Water Pump Drive Gear
5. Lube Oil Jet
6. Crankshaft Gear
7. Oil Flinger (if equipped)
8. Hydraulic Pump Idler Gear (if equipped)
9. Lube Oil Jet
10. Timing Slots

### 2. REMOVAL

**NOTE:** *Whenever it is necessary to loosen or remove any interior engine bolts which are retained by lock plates, the lock plates should be replaced. Repeated bending could cause these tabs to break off and fall into the engine, which could possibly cause engine damage during operation.*

1. Remove the alternator from its mounting bracket.
2. Remove the air compressor (if equipped).
3. Remove the fan drive housing from the front cover (Refer to Section 6, "FAN DRIVE HOUSING AND THERMOSTATS.")

**NOTE:** *Removal of the fan drive is necessary to gain access to two cap screws that secure the front cover to the crankcase.*

4. Remove the crankshaft nut.
5. Position Service Tool No. PLT-506 in place on the vibration damper and secure it with cap screws (Fig. 2). Then by turning the puller bolt inward, the damper will come off the crankshaft. However, if the damper sticks, strike the puller bolt head with a hammer to free the taper fit.

**NOTE:** *Be careful when breaking the damper free of crankshaft taper in this manner as the damper will have the tendency to spring outward with force due to the tension of the puller.*

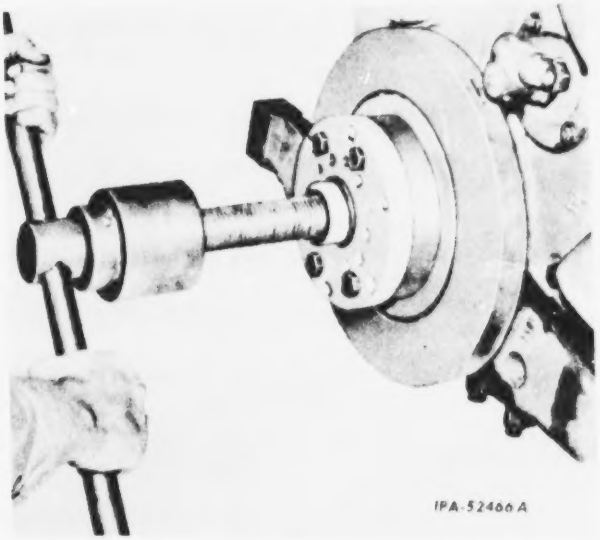



**Fig. 2. Removing Vibration Damper**

6. Remove the tachometer drive and drive pin or service recorder (if equipped) (Fig. 3).

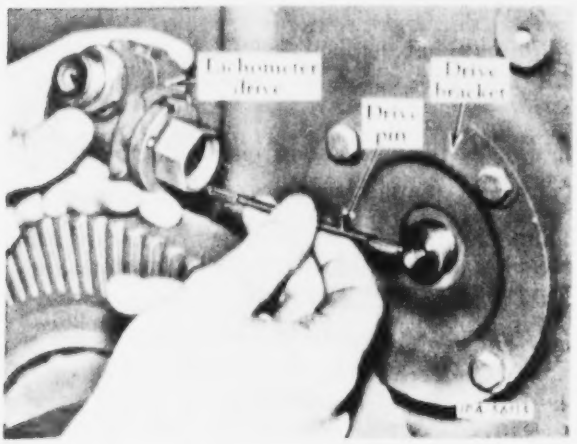



**Fig. 3. Removing Tachometer Drive**

7. Drain the oil from the crankcase oil pan. Remove the cap screw securing the scavenging lube oil pump manifold (if equipped) to the scavenging lube oil pump. Remove the oil pan with scavenging pump manifold attached.

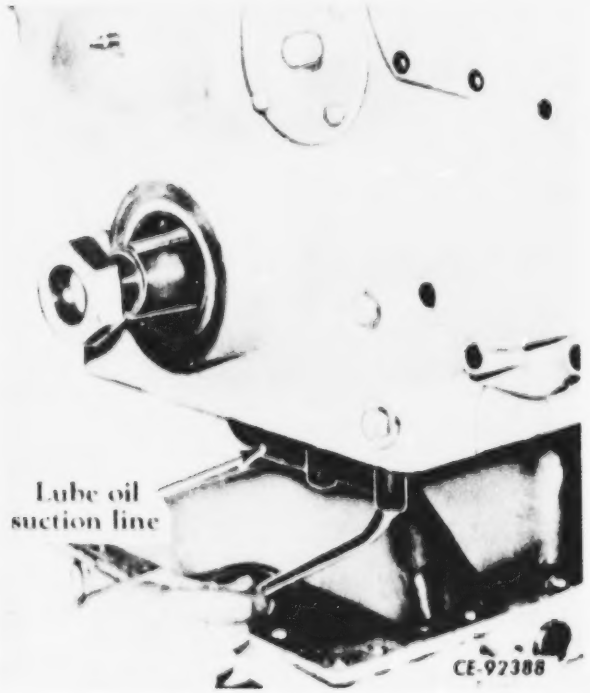



**Fig. 4. Loosening Lube Oil Suction Line**

**NOTE:** *The crankcase oil pan must be removed in order to disconnect the lube oil suction line from the front cover.*

8. Remove the two cap screws securing the lube oil suction pipe to the front cover (Fig. 4).

9. Remove the cap screws securing the front cover to the crankcase. Be sure to remove the two cap screws and locks located in the fan drive housing opening of the front cover. Attach a hoist to the front cover and tap the front cover off the locating dowel pins. Remove the front cover (Fig. 5).

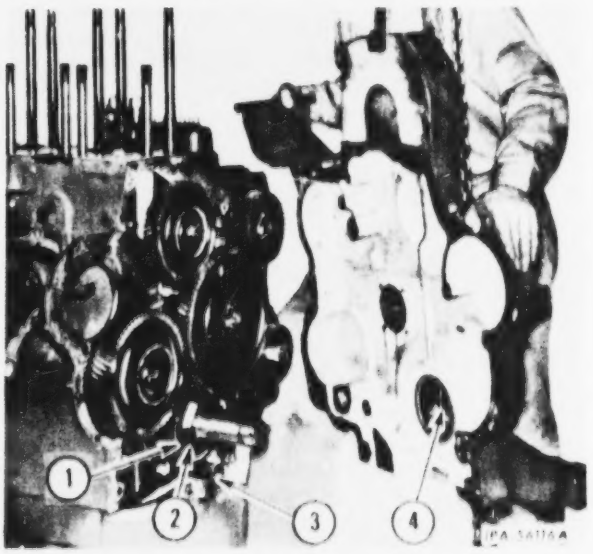



**Fig. 5. Removing Crankcase Front Cover.**

1. Oil Flinger (Early Models).
2. Crankshaft Gear Nut.
3. Lube Oil Suction Line.
4. Oil Seal.

**NOTE:** *Check the backlash between every set of gears before removal to determine which gears need service (Fig. 19). Refer to "SPECIFICATIONS' in Section 1, for specified backlash.*

10. Remove the crankshaft gear nut and oil flinger (if equipped) (Fig. 5). Crank the engine until the timing marks on the crankshaft gear, camshaft gear and the injection pump drive gear are in line. Remove the four cap screws and washers (or lock plate) securing the camshaft gear to the camshaft and remove the gear (Fig. 6).

**NOTE:** *After the camshaft gear is removed, DO NOT TURN the crankshaft without first back-*

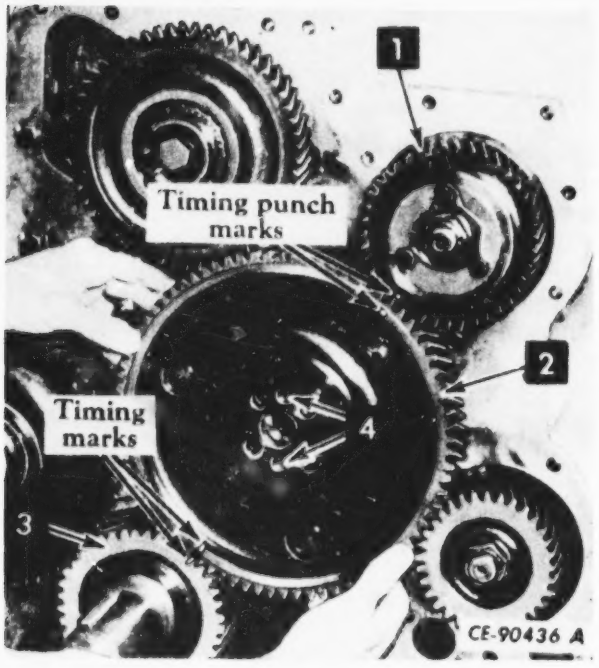



**Fig. 6. Removing Camshaft Gear**

1. Injection Pump Drive Gear
2. Camshaft Gear
3. Crankshaft Gear
4. Locating Dowels

*ing off all the valve lever adjusting screws. This is to relieve the valve levers in order that all the valves will be seated to avoid damage by piston up-strokes.*

11. If equipped with hydraulic pump idler gear, remove the hydraulic pump idler gear shaft bolt and bearing retainer. (This bolt has a left hand thread.) Remove the gear with bearing outer cone (Fig. 7). Slide the bearing spacer and bearing inner cone off the shaft. Tag or mark the bearing cones "inner" and "outer" to retain the same wear pattern in the cup when reassembled. Remove the three bolts and locks from the gear shaft and tap the shaft off the dowel pins.

12. Remove the fan drive idler gear shaft bolt and bearing retainer. (This bolt has a left hand thread.) Remove the gear and bearing in the same manner as the hydraulic pump idler gear. Also, tag or mark the bearing cones for identification during reassembly.

**NOTE:** *If the fan drive idler gear shaft is to be removed, punch mark one of the locating dowels and the shaft casting next to the dowel. This*

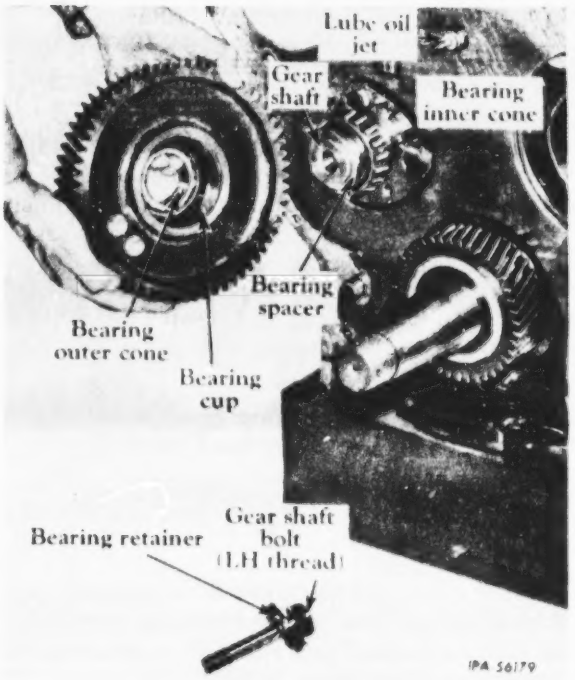



**Fig. 7. Removing Hydraulic Pump Idler Gear**

*will insure the correct installation of the shaft upon reassembly. (Refer to Par. 4, "INSTALLATION.")*

13. Remove the cap screw securing the fan drive idler gear shaft to the crankcase and remove the shaft (Fig. 8).

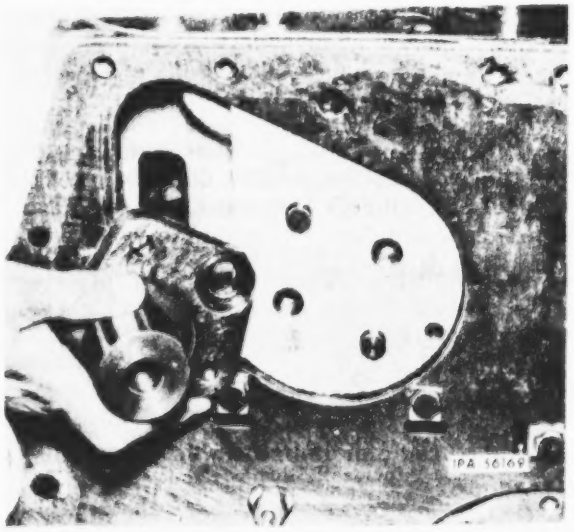



**Fig. 8. Removing Fan Drive Idler Gear Shaft**

14. Remove the crankshaft gear (Fig. 9).

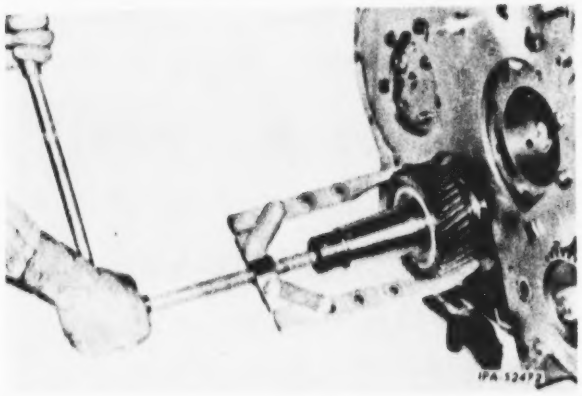


**Fig. 9. Removing Crankshaft Gear**

15. Remove the injection pump drive gear with gear hub attached, and the lube oil and water pump drive gear with a standard gear puller after removing the nuts securing these gears to their respective shafts. On engines equipped with hydraulic pump, the pump gear can be removed after removing the adapter from the pump shaft and the snap ring from the pump drive housing.

16. If the crankcase front plate is to be removed proceed as follows:

a. If equipped with a hydraulic pump, disconnect the oil line manifold to allow the pump to be removed with the front plate.

b. Disconnect all lines to the fuel injection pump. Remove the two bolts, nuts and washers securing the injection pump to the mounting block. Remove the adapter housing with the fuel injection pump attached.

c. Remove the lube oil and water pump. (Refer to Section 7, "LUBRICATION OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS.")

d. Remove the cap screws and lock securing the front plate to the crankcase. Tap the front plate off the locating dowels and remove the plate (Fig. 10).

### 3. INSPECTION AND REPAIR

1. Clean all parts thoroughly in a solvent and blow dry with compressed air.

2. Inspect all gears for wear, chipped teeth or otherwise damaged condition, and replace as necessary.

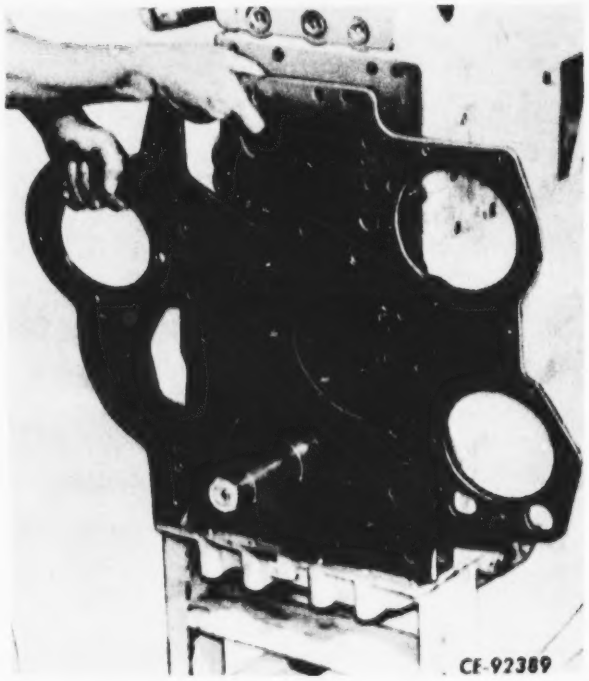



**Fig. 10. Removing Crankcase Front Plate**

**NOTE:** *If any gear is to be replaced, because of damaged teeth, all of the gears that mesh with it must also be replaced.*

3. Inspect the fan drive and hydraulic pump idler gear bearings for chipped or pitted rollers and damaged cups. If any one of the parts of these bearings is excessively worn the complete bearing must be replaced, as the bearing is furnished only as an assembly.

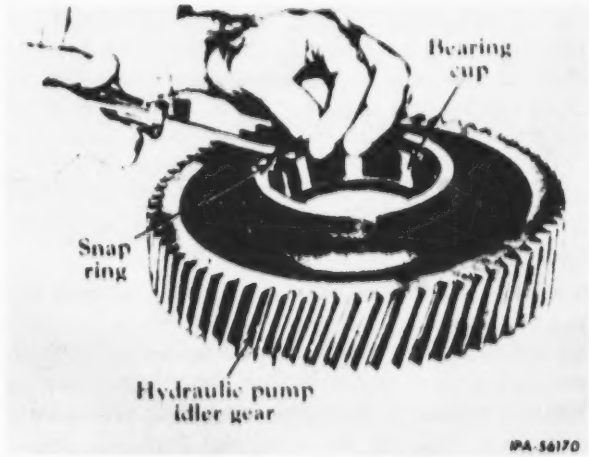



**Fig. 11. Removing Bearing Cup Retaining Snap Ring**

4. In order to remove the bearing cup in the gear, the retaining snap ring must be removed (Fig. 11) and the cup pressed out of the gear.

5. To make installation of the new cup easier, it is suggested that the cup be placed in dry ice for a short time. Then press the cup into the gear until it seats on the shoulder in the gear and install the retaining snap ring.

**Procedure for Servicing and Adjusting The Fan Drive Idler Gear, and Hydraulic Pump Idler Gear Roller Bearings**

The tapered roller bearings and spacer are furnished as a matched unit, so a definite procedure for adjustment of the tapered roller bearings, due to normal wear, must be followed.

1. Assemble the complete bearing assembly on a flat surface (surface plate).

2. Place a minimum 9 kg (20 lb) weight on top of bearing assembly as shown in Fig. 12. This will keep rollers in alignment.

**NOTE:** *Be sure to place parallels or spacers on the bearing, and then rest the weight on top of the parallels or spacers. This is done to keep the weight concentrated on the cone. The same must be done between the bottom surface of the bearing cone and the surface plate (Fig. 12). Bottom parallels must be of equal thickness.*

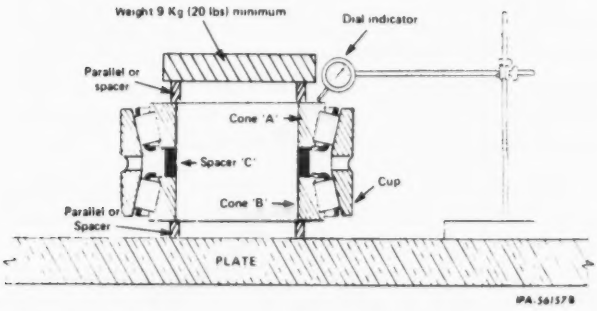



**Fig. 12. Adjustment of Tapered Roller Bearings**

3. Rotate the cup a minimum of four revolutions in each direction.

4. With the spacer "C" in place, set the dial indicator at zero. Check at three different points.

5. Slide dial indicator off the cone "A" carefully. (Do not upset indicator setting.)

6. Remove the weight parallels, upper cone "A" and spacer "C." Then reinstall the upper cone parallels and the weight. (Do not reinstall the spacer "C.")

7. Repeat rotation of the cup and slide dial indicator on the cone "A." Be careful to get accurate reading from dial indicator. Check at three different points.

8. The factory end play specification in a new bearing assembly is 0.23-0.30mm (0.009-0.012 in) (for idler shaft bearing)or 0.23-0.28mm (0.009-0.011 in) (hydraulic pump idler gear bearing). If the reading on dial indicator shows a greater drop than the maximum factory set end plate, grinding or lapping of the spacer "C" is necessary. The amount to be ground off of the spacer is the difference between the indicator reading and the factory set end play.

**NOTE:** *A bearing assembly that is heavily pitted or scored must NOT be salvaged.*

**Front Oil Seal and Wear Sleeve Replacement**

9. Secure the vibration damper hub in a soft-jawed vise. Be sure the vise jaws grasp only the hub casting.

10. Using a chisel, cut part way through the wear sleeve. This will increase the size of the sleeve. Remove the sleeve.

**NOTE:** *Do not cut completely through the sleeve.*

11. Remove any nicks or scratches from the wear sleeve surface of the hub with a crocus cloth.

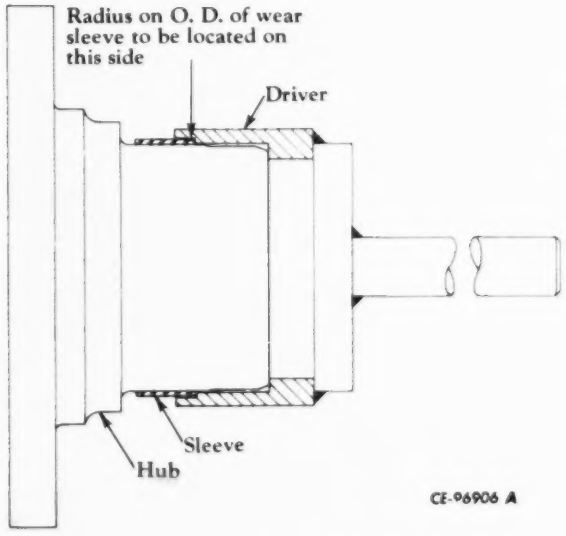



**Fig. 13. Vibration Damper Hub with a Wear Sleeve and Driver**

# TIMING GEAR TRAIN, FRONT COVER AND CAMSHAFT

12. Install a new wear sleeve as follows:

a. Apply a light coat of R.T.V. liquid gasket (Dow 732, General Electric 1473 or equivalent) onto the wear sleeve surface of the damper hub.

b. Press the new wear sleeve on to the hub with driver PLT-542 until driver bottoms on the hub face (Fig. 13).

13. Press the oil seal out of the front cover. Thoroughly clean the seal bore in the housing and remove any nicks and scratches.

14. Press in the new oil seal. Use a tool of sufficient diameter to press on the OD of the seal.

15. Inspect the viscous vibration damper for the following:

a. Dents – Even small dents can cause inner space member, which floats in silicone fluid, to contact outer housing. Such contact can cause damper malfunction. Replace dented dampers.

b. Leaks – Clean damper thoroughly and inspect for silicone fluid leaks. Such leaks can occur at cracks or seam openings in housing. Replace damper if any leaks are found.

**Fig. 14. Installing Crankshaft Gear**

Viscous dampers are designed to operate for as many hours or miles as other major engine components. Therefore, except for those cases mentioned above, dampers do not need to be replaced except at major overhauls.

## 4. INSTALLATION

1. If the crankcase front plate was removed, reinstall as follows:

a. Install a new gasket to the front of the crankcase and install the front plate with the hydraulic pump attached. Secure the front plate with cap screws and locks.

b. If equipped with hydraulic pump, connect the oil line manifold to the pump.

c. Install the adapter housing with injection pump attached. Secure the adapter housing to the crankcase front plate. Secure the injection pump to the mounting block. Connect all lines to the injection pump.

d. Install the lube oil and water pump. (Refer to Section 7, "LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS.")

2. Install the crankshaft gear key. Heat the crankshaft gear to 245°C (475°F). Using asbestos gloves, position the gear on the crankshaft with the timing mark facing out (Fig. 14). Be sure that the gear is not cocked on the crankshaft. Drive the gear into position.

3. Install the injection pump drive gear with gear hub attached and the lube oil and water pump drive gear. Install the gear retainer nuts. Tighten the injection pump drive gear nut to 217 N.m (160 ft-lbs) torque. Tighten the lube oil and water pump drive gear nut to 190 N.m (140 ft-lbs) torque.

4. On engines equipped with hydraulic pump, place the pump gear and bearing assembly on the pump drive housing and secure with snap ring. Install the drive adapter with snap ring on the pump shaft and secure to the gear with cap screws and locks.

5. Install the fan drive idler gear shaft to the crankcase, aligning the punch marks made on the dowel and casting before removal. Secure the shaft with a cap screw and lock.

**NOTE:** *The fan idler gear shaft and the fan drive housing can be installed in one of two positions (180 degrees apart) depending upon engine application. (Refer to Chart and Figs. 15 thru 18.) The idler gear shaft and housing must be installed in the proper positions for the fan*

*drive gear and the idler gear to mesh properly. The chart and illustrations provide information for installing these components properly in order to obtain the correct fan speed for the cooling system involved.*

6. Slide the fan drive idler gear bearing cone and the spacer onto the shaft similar to Fig. 19. Install the fan drive idler gear and bearing outer cone and secure the gear with the idler gear shaft bolt and bearing retainer. Rotate the gear to seat the bearing and tighten the bolt to 203 N.m (150 ft-lbs) torque. Bend the bolt lock over the flats of the bolt head.

7. Install the hydraulic pump idler gear shaft and secure with three cap screws and locks.

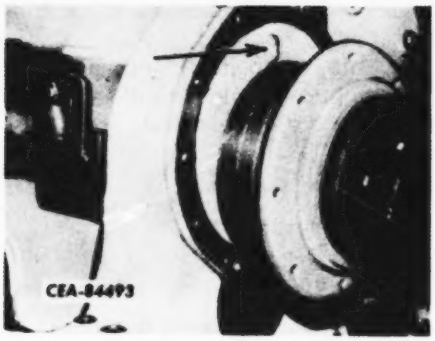



**Fig. 15. Fan Drive Housing Installed with Locating Boss Up**

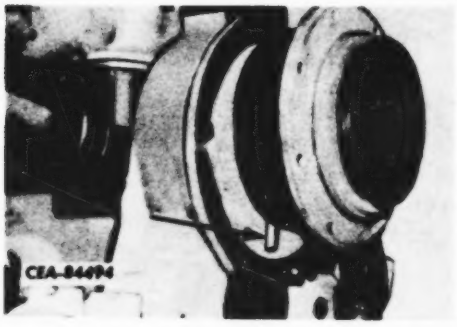



**Fig. 16. Fan Drive Housing Installed with Locating Boss Down**

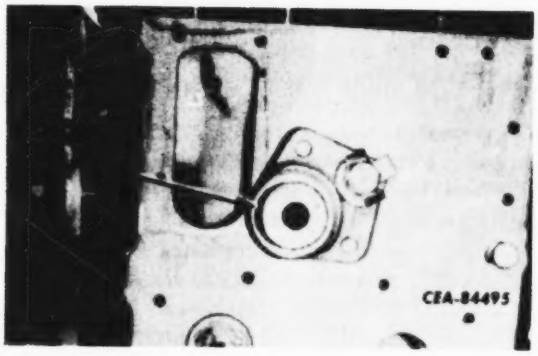



**Fig. 17. Fan Idler Gear Shaft in Low Position**

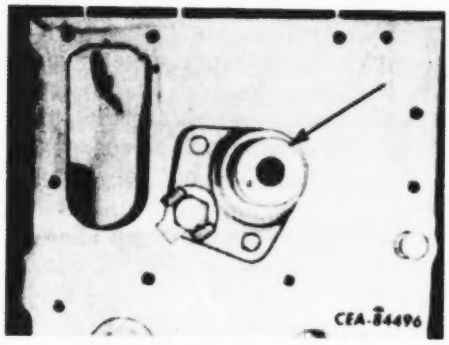



**Fig. 18. Fan Idler Gear Shaft in High Position**

| MACHINE | FAN DRIVE GEAR<br>POSITION OF HOUSING LOCATING BOSS (Figs. 15 & 16) | IDLER GEAR SHAFT POSITION (Figs. 17 & 18) |
|---|---|---|
| TD-25 SERIES C | Filler plug up (not illustrated) | High |
| UDT and UDTI-817 SERIES C | Up | Low |
| 330 and 340 Pay haulers, H-100C Pay loader | Down | High |
| 560 Pay loader | Up | Low |

8. Install the hydraulic pump idler gear and bearing in the same manner as the fan drive idler gear (Fig. 19). Secure with the shaft bolt and bearing retainer. Rotate the gear to seat the bearing and torque the bolt to 305 N.m (225 ft-lbs). Bend the bolt lock over the flats of the bolt head.

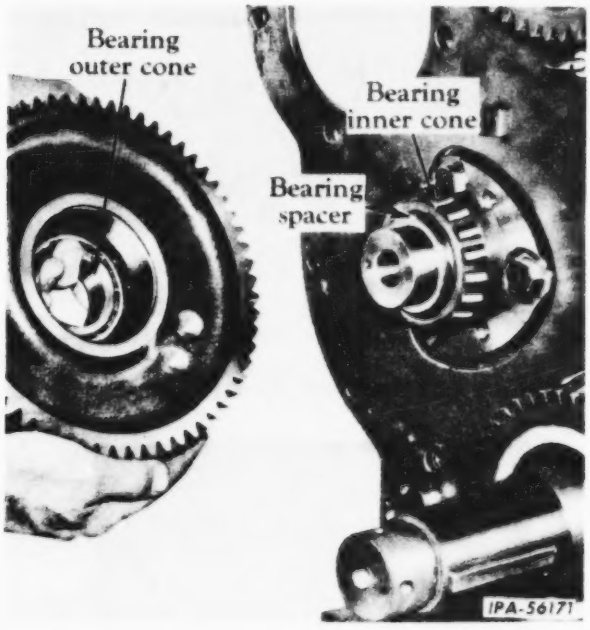



**Fig. 19. Installing Hydraulic Pump Idler Gear**

**NOTE:** *The hydraulic pump idler gear shaft bolt has a left hand thread.*

9. Install the camshaft gear so that the timing marks stamped on the crankshaft gear, injection pump drive gear and camshaft gear are in line. (Refer to Fig. 6.)

**NOTE:** *One of the camshaft locating dowel pins is off center, therefore the gear cannot be installed 180 degrees out of time.*

10. Install the camshaft gear washers and secure with four cap screws.

11. Check the backlash between every set of gears with a dial indicator (Fig. 20). Refer to "SPECIFICATIONS" in Section 1, for the specified backlash.

12. Check to be sure that the gear train upper and lower lubricating oil spray jets are set at the correct angle as shown in Fig. 21. These spray angles are the most effective to lubricate all the gears in the train.

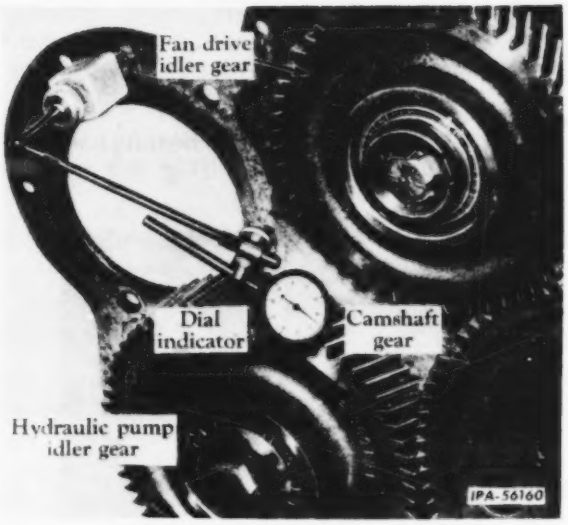



**Fig. 20. Checking Backlash**

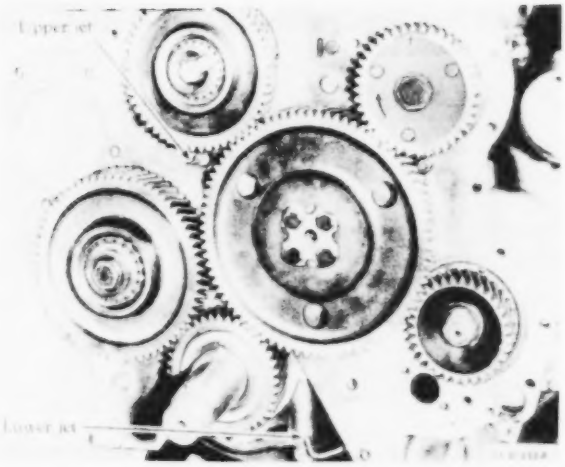


**Fig. 21. Gear Train Lubricating Oil Spray Jets**

13. Install the oil flinger (see NOTE) and crankshaft gear nut (Fig. 5). With wrench adapter PLT-518, torque the nut to 712 N·m (525 ft-lbs). When using a wrench adapter PLT-518, the reading on the torque wrench should be 594 N·m (438 ft-lbs).

**NOTE:** *The oil flinger is not required and may be eliminated from engine, however, it may be reused if in good condition.*

14. Apply a thin film of non-hardening sealer to the gasket surface of the front cover and crankcase front plate and install a new front cover gasket. Install the front cover (Fig. 5) and secure with cap screws. Be sure to install the two cap screws and locks located in the fan drive housing opening of the front cover.

15. Connect the lube oil suction pipe to the bottom of the front cover (Fig. 4). Secure with two cap screws.

**NOTE:** *The gasket between the suction pipe and the front cover must be installed with the color coded side of the gasket against the front cover which is the "UP" side.*

16. Install the crankcase oil pan and scavenging oil pump manifold (if equipped). Be sure that the scavenging oil pump manifold "O" rings are in place. Install and tighten the oil pan drain plugs 47 N.m (35 ft-lbs).

17. Install the tachometer drive pin and drive or service recorder (if equipped) (Fig. 3).

18. Install the vibration damper, and damper hub nut and torque the nut to 475 N·m (350 lbf-ft) for nylon pellet nut or 542 N·m (400 lbf-ft) for nylok patch nut.

19. Install the fan drive housing. Refer to Section 6, "FAN DRIVE HOUSING AND THERMOSTATS."

20. Install the air compressor (if equipped) and the alternator. For H-560 Pay Loaders, torque the 1/2 inch air compressor mounting bracket bolts to 115 N.m (85 ft-lbs).

21. If the valve lever adjusting screws were backed off, adjust the valve clearance. Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES."

## CAMSHAFT

### 5. DESCRIPTION

The camshaft is located in the crankcase on the left hand side of the engine, and is held to the crankcase by a hub which takes the thrust. The camshaft is supported at intervals along its length by seven bushings. The bushings are removable and are furnished for service reamed to size. Fig. 22 shows the camshaft components. The bushings are a press fit in the crankcase.

The camshaft has the main function of operating the intake and exhaust valve mechanism by action of its lobes upon the tappets to the push rods during rotation.

It is important to notice that the camshaft gear has twice as many teeth as the crankshaft gear which drives it. The camshaft, therefore, rotates at one-half of the crankshaft speed due to the requirement to open and close the valves to each cylinder once for every two revolutions of the crankshaft.

The camshaft bearings are pressure lubricated and have oil holes drilled in them. When the bushings are installed, the oil holes must align with the ones drilled in the crankcase. Slots in two of the journals permit lubricating oil to travel to the lever mechanism.

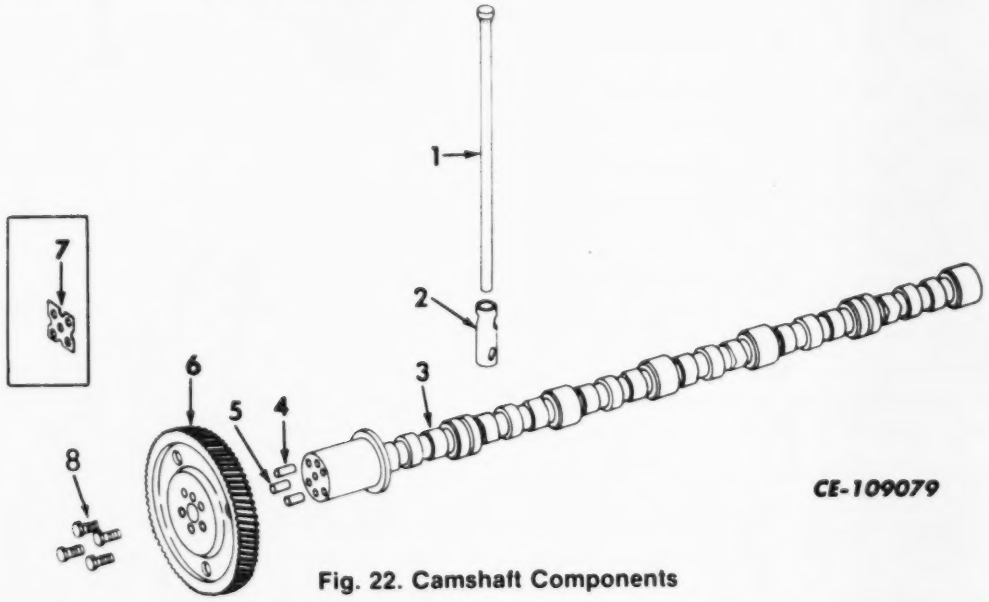



**Fig. 22. Camshaft Components**

1. Valve Push Rod
2. Valve Tappet
3. Camshaft
4. Dowel Pin
5. Tachometer Drive Plug
6. Camshaft Gear
7. Lockplate (replaced with new screw (ref. 8) and hardened washers)
8. Screw

**6. REMOVAL**

1. Remove both rocker arm assemblies and push rods. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES.")

2. Remove both push rod chamber covers on the left side of the engine.

3. Remove the valve tappets (Fig. 23).

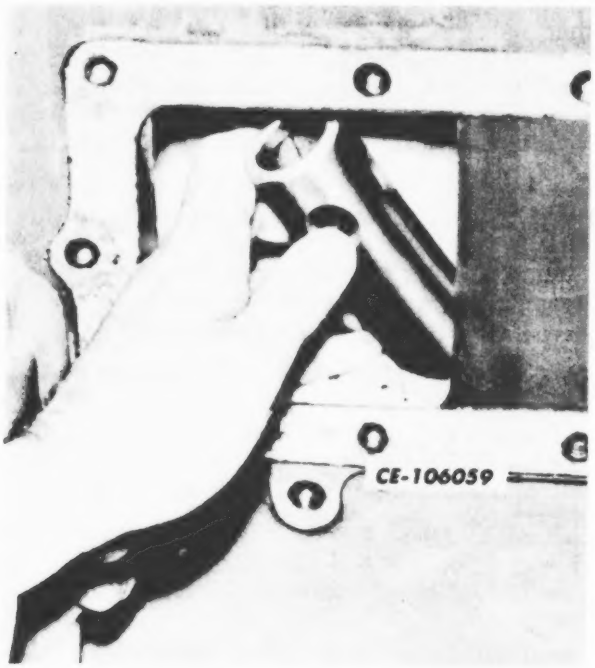



**Fig. 23. Removing Valve Tappet**

**NOTE:** *Mark the tappets as to location in the engine block, so that they can be returned to their original position.*

4. Remove the crankcase front cover. Refer to Par. 2 in this section. Remove the crankshaft gear nut.

5. Crank the engine until the timing marks on the crankshaft gear, camshaft gear and the injection pump drive gear are in line.

**NOTE:** *Before removing the camshaft gear, check the camshaft end play (Fig. 27) to determine if new parts are required. Refer to "SPECIFICATIONS" in Section 1, for specified end play.*

6. Remove the four cap screws and washers (See NOTE) securing the camshaft gear to the camshaft and remove the gear (Fig. 6).

**NOTE:** *If equipped with a lock plate, discard plate and replace with new screws and washers. Refer to Parts Catalog for new hardware.*

7. Remove the five cap screws and lock securing the camshaft thrust bearing hub to the crankcase and remove the hub (Fig. 24).

8. Remove the camshaft (Fig. 25). (Support the camshaft along its length, as it is being removed, to prevent the cam lobes from damaging the bushings.)

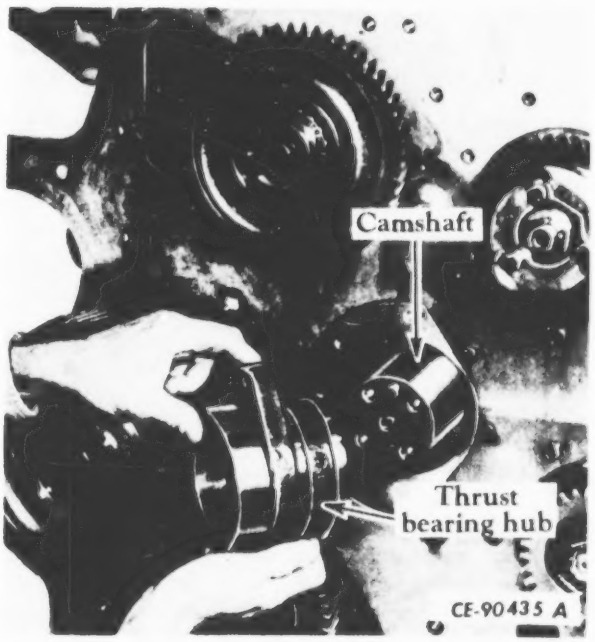



**Fig. 24. Removing Camshaft Thrust Bearing Hub**

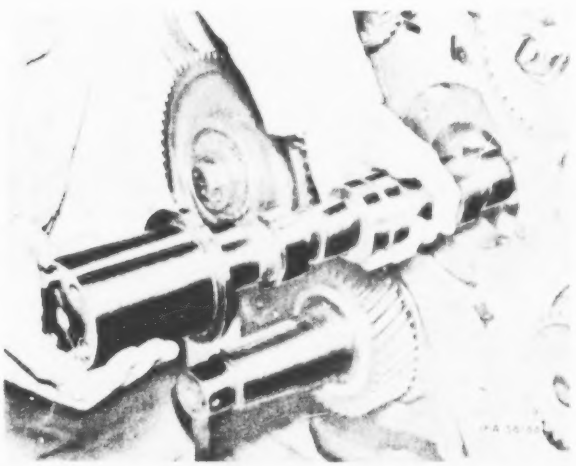


**Fig. 25. Removing Camshaft**

## 7. INSPECTION AND REPAIR

1. Clean all parts in a cleaning solvent and dry with compressed air. As inspection of parts is completed, coat each with clean engine oil and store safely until reassembly. Do not damage the journals and lobes of the camshaft or the teeth of the gear.

2. Inspect the journals for wear. Dimensions for the camshaft journals are given in "SPECIFICATIONS" in Section 1. Compare those of the camshaft being serviced with the ones listed. If the journals are worn beyond the limits specified, replace the camshaft.

3. Replace the camshaft if any of the valve lobes are scuffed, scored or cracked.

4. Inspect the lobes for wear. Refer to "SPECIFICATIONS" in Section 1 for cam lobe lift when new and for the maximum permissible lobe wear. If the lifting areas of the cam lobes, when compared with a new camshaft, show excessive wear, the camshaft must be replaced. If a new camshaft is not available for comparison, the cam lobe wear can be measured with a micrometer in the following manner (Fig. 26):

Take a reading across A-C and deduct the reading B-D: this will give the lobe lift. When the cam lobe wear limit has been reached, the camshaft must then be replaced with a new one.

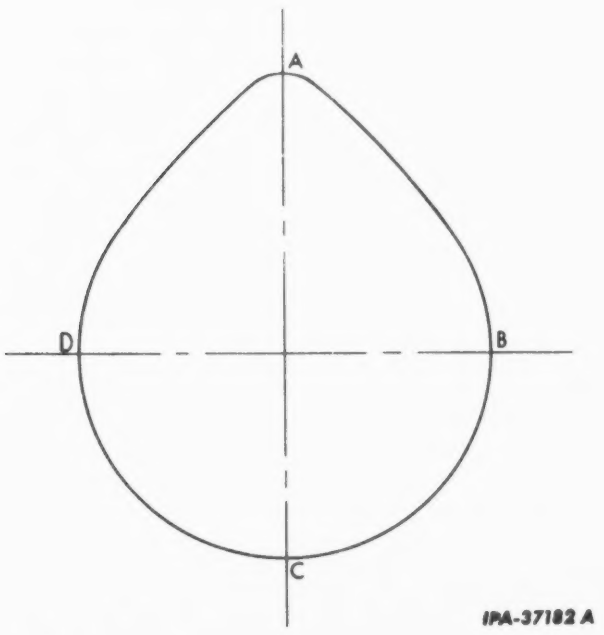



**Fig. 26. Points of Measurement to Determine Cam Lobe Wear**

5. Inspect the thrust bearing hub and the thrust face on the camshaft for wear, due to lack of specified end clearance. Replace parts if necessary.

6. The bushings must be inspected for wear and, if replacement is necessary, remove the flywheel and flywheel housing. (Refer to Section 4, "CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL.") Pull or press the bushings from position.

7. Inspect the bushing bore in the crankcase for burrs and other roughness liable to damage the bushings when installation takes place.

8. When installing new bushings, be sure that the oil holes in the bushings line up with the oil holes in the crankcase.

9. The two bushings in the thrust bearing hub must be pressed in from the outside of the hub bore until the outer edges of the bushings are flush with the hub (Fig. 24). This provides a channel between the bushings for lubricating oil to the gear train and the front main bearing.

10. Inspect the valve tappets. Replace any that are scuffed, scored or cracked. If the tappet face is badly chipped, extreme wear can be expected in the cam lobe and a new camshaft must be installed.

## 8. INSTALLATION

1. Lubricate cams and journals with clean engine oil and install the camshaft. (Support the camshaft along its length when installing it to prevent the cam lobes from damaging the bushings.)

2. Lubricate bearing with clean engine oil and install bearing. Install the thrust bearing hub and secure with five cap screws and locks.

3. Install the camshaft gear so that the timing marks stamped on the crankshaft gear, camshaft gear and injection pump drive gear are in line.

4. Install camshaft gear washers and screws (8, Fig. 22). Torque to 122 N.m (90 ft-lbs).

5. Check the backlash between the camshaft gear and mating gears with a dial indicator (Fig. 20). Refer to "SPECIFICATIONS" in Section 1 for the specified backlash.

6. Check the camshaft end play with a dial indicator (Fig. 27). Refer to "SPECIFICATIONS" in Section 1 for the specified end play.

7. Install the crankshaft gear nut and oil flinger (see NOTE). Install the crankcase front cover and vibration damper. Refer to Par. 4 in this section.

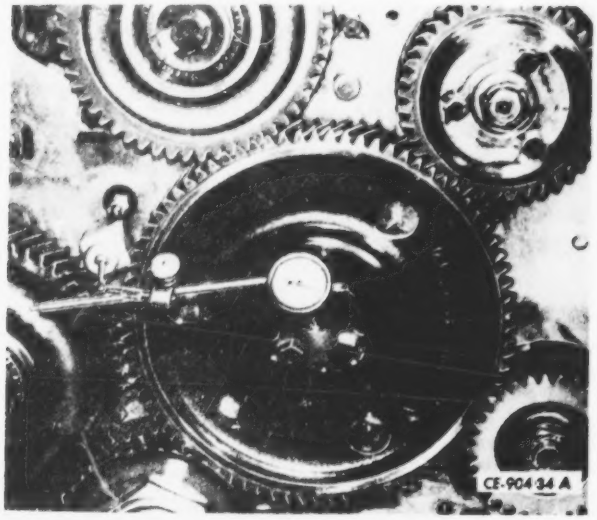



Fig. 27. Checking Camshaft End Play

**NOTE:** *The oil flinger is not required and may be eliminated from the engine. However, it may be reused if in good condition.*

8. Coat the valve tappet faces with Dow Corning Molykote "G-n" lubricant or Fel Pro C-670 paste and tappet OD with clean engine oil. Install the valve tappets. Be sure to install the tappets in their original positions using the marks made in removal.

**NOTE:** *Be sure that the tappets move freely in their bores.*

9. Install both push rod chamber covers.

10. Install the push rods and rocker arm assemblies and adjust the valve lash. (Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES.")

**NOTE:** *It is recommended that the engine be run at 1000 rpm from three to five minutes after finishing assembly of the engine. At this rpm the tappets are under lighter load, thus initial lubrication at the tappets and tappet bores will be assured.*

## FAN DRIVE HOUSING

### 1. DESCRIPTION

The fan drive housing is attached to the crankcase front cover. The fan drive gear is driven by the fan idler gear in the gear train. The fan is attached to the fan mounting assembly which is keyed to the fan drive shaft. One belt on the fan hub and pulley assembly drives the alternator and another belt can be installed to the hub and pulley to drive an air compressor when used.

### 2. MAINTENANCE

If excessive fan slippage is thought to be the cause of some problem in the cooling system such as engine overheating, the fan slip clutch can easily be checked for the proper torque as outlined in the following paragraph.

**Checking Fan Slip Clutch Torque on Engine**

1. With the fan guard, fan and fan spacer (560 application only) removed, bolt the torque adapter (prefabricated as per Fig. 1) to the fan mounting flange. Use two 3/8 x 3-1/4" UNC grade 8 bolts for 560 application and two 3/8 x 3-3/8" UNC grade 8 on all other applications. (See NOTE).

NOTE: *Make sure torque adapter bolts DO NOT touch the pulley after mounting.*

2. Hold the crankshaft by holding the 1-3/4 inch nut on the crankshaft pulley.

3. Use a torque wrench on the 3/4 inch bolt head (center of torque adapter) to check torque required to slip the fan clutch. (See NOTE).

NOTE: *Only check torque in the clockwise direction.*

4. Torque should be 215-405 N·m (160-300 lbf-ft). If clutch torque is not within specifications, remove the fan drive and replace the fan mounting assembly as follows.

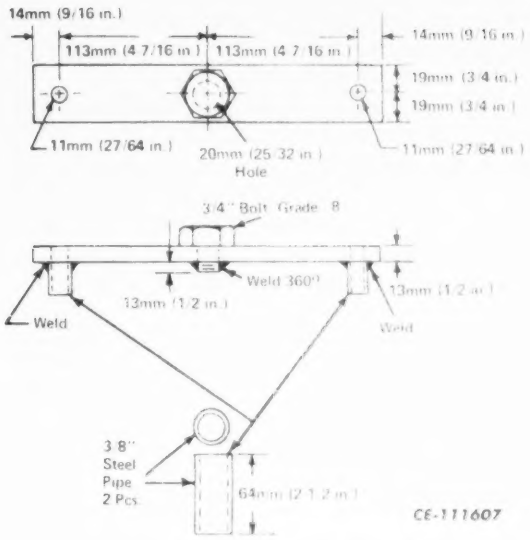



Fig. 1. Torque Adapter.

### 3. REMOVAL

1. Loosen the freon compressor adjusting bolts, move the freon compressor down towards the crankcase, and remove the freon compressor belt (if equipped).

2. Loosen the alternator brace hex head bolt and move the alternator towards the crankcase to obtain slack in the alternator belt. Remove the alternator belt.

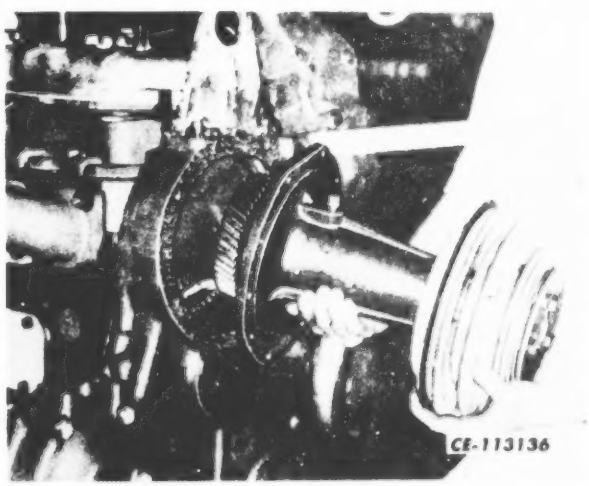



Fig. 2. Removing the Fan Drive Assembly.

# FAN DRIVE HOUSING AND THERMOSTATS

3. Loosen the air compressor adjusting bolt, move the air compressor in towards the crankcase and remove the air compressor belt (if equipped).

4. Remove the hex head bolts, washers, bolt locks and retainer plate (not used on 330 and 340 PAY-haulers) from the fan mounting assembly.

5. Remove the hex head bolts and nuts securing the fan drive housing to the front cover. Remove the fan drive assembly and gasket (Fig. 2).

## 4. DISASSEMBLY

1. Support the fan drive assembly by clamping the gear in a vise. Use soft, protective vise jaws being careful not to damage the drive gear.

2. Remove the front nut from the shaft.

3. Remove the fan mounting assembly or belt pulley from the housing assembly with a puller attached as shown in Fig. 3 so as not to damage the rubber member.

## 5. SERVICE DIAGNOSIS

1. Refer to the following chart and replace the proper item(s) that corresponds with problem encountered on engine.

2. Check the fan blades for looseness and bends, repair or replace if necessary.

3. If the drive gear is reason for replacement of the housing assembly, also check the fan idler gear for damaged teeth and repair if necessary. Refer to Section 5, "TIMING GEAR TRAIN, FRONT COVER AND CAMSHAFT."

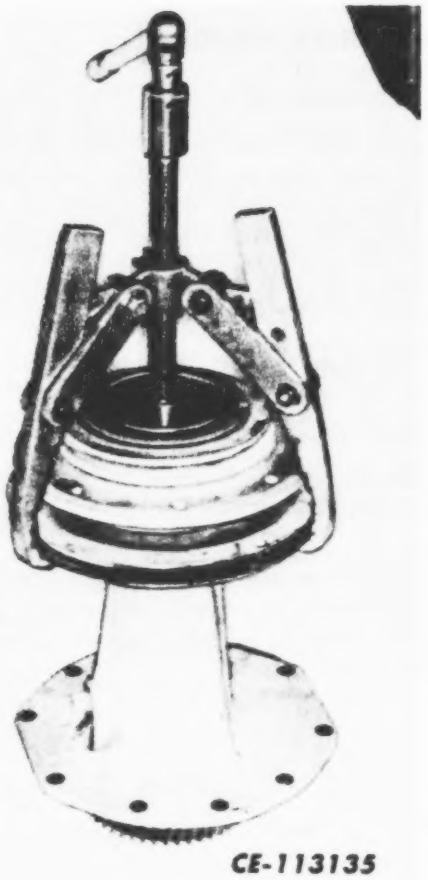



**Fig. 3. Removing Fan Drive Assembly.**

| PROBLEM | REPLACE |
|---|---|
| Engine overheating due to the fan slipping continuously. Improper torque of fan mounting assembly. Rubber member separation of fan mounting assembly ..... | Fan mounting assembly. |
| Shaft wobble. Fan mounting assembly not turning. Oil leakage ..... | Housing assembly. |
| Fan wobbling ..... | Complete drive assembly. |
| **560 Only:** Fore and aft play in the fan, excessive radial movement and knocking..... | Fan mounting assembly. Fan spacer. |

## 6. CHECKING FAN SLIP CLUTCH TORQUE WHEN REMOVED FROM ENGINE

1. Support the fan mounting assembly by clamping the pulley in a vise. Use soft, protective vise jaws, being careful not to damage the pulley (Fig. 4).

2. Bolt the torque adapter to the fan mounting flange (per "Checking Fan Slip Clutch Torque on Engine" Par. 2 in this section.

3. Use a torque wrench on the 3/4 inch bolt head (center of torque adapter) to check torque required to slip the fan clutch.

4. Torque should be 215-450 N·m (160-300 lbf-ft). If clutch torque is not within specification, replace the fan mounting assembly.

NOTE: *Break the clutch loose five (5) times to seat the friction plates before recording the torque value.*

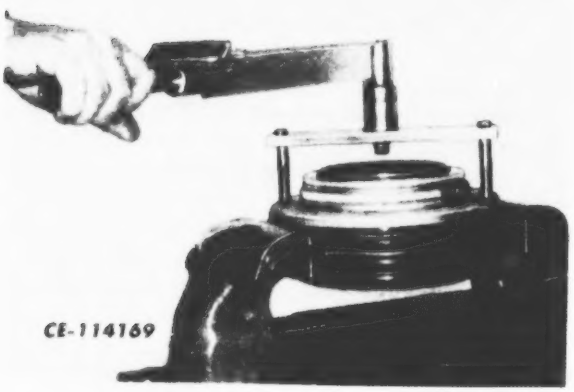



Fig. 4. Checking Clutch Slip Torque.

## 7. DISASSEMBLY OF FAN MOUNTING ASSEMBLY (Not used on 330/340 PAYhaulers)

1. Support the fan mounting assembly in a press using the coupling flange support tool (Fig. 5). Fabricate tool from 5 inch I.D. XS pipe (see (NOTE).

NOTE: *Make sure the support tool slips through the slots in the rear of the pulley and supports the coupling flange only; otherwise, damage will occur to the rubber member.*

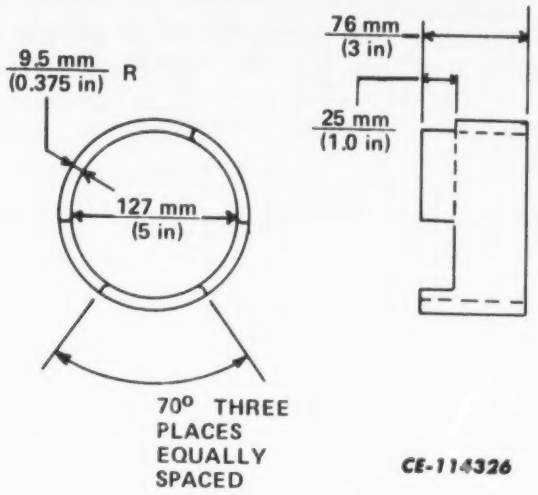
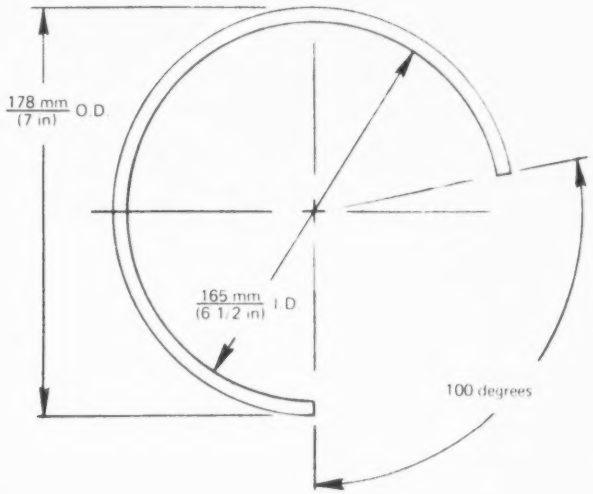



Fig. 5. Coupling Flange Support Tool.



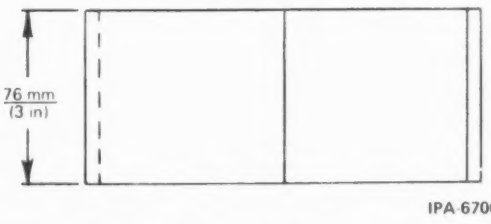




Fig. 6. Belleville Spring Compressing Tool.

# FAN DRIVE HOUSING AND THERMOSTATS

2. Place the belleville spring compressing tool (Fig. 6) on top of the fan mounting assembly.

3. Place a steel bar across the top of the compressing tool and compress belleville spring.

4. Remove the snap ring with snap ring pliers (Fig. 7).

5. Slowly release the pressure of the press on the belleville spring.

6. Remove the fan mounting assembly from the press.

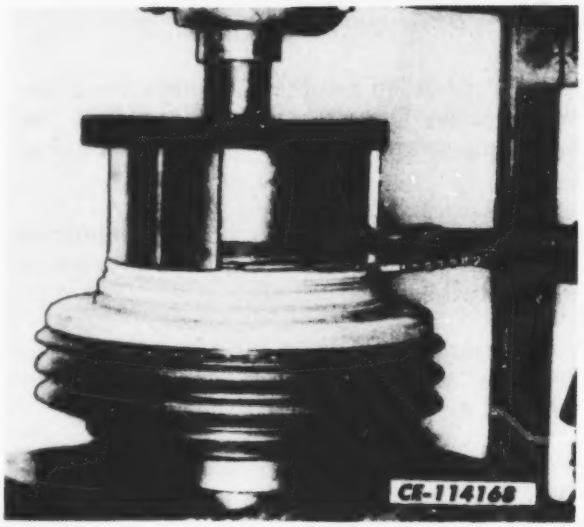



Fig. 7. Snap Ring Removal.

## 8. INSPECTION AND REPAIR OF FAN MOUNTING ASSEMBLY

1. Refer to the dimensional drawing (Fig. 8) and replace any part that does not meet specifications

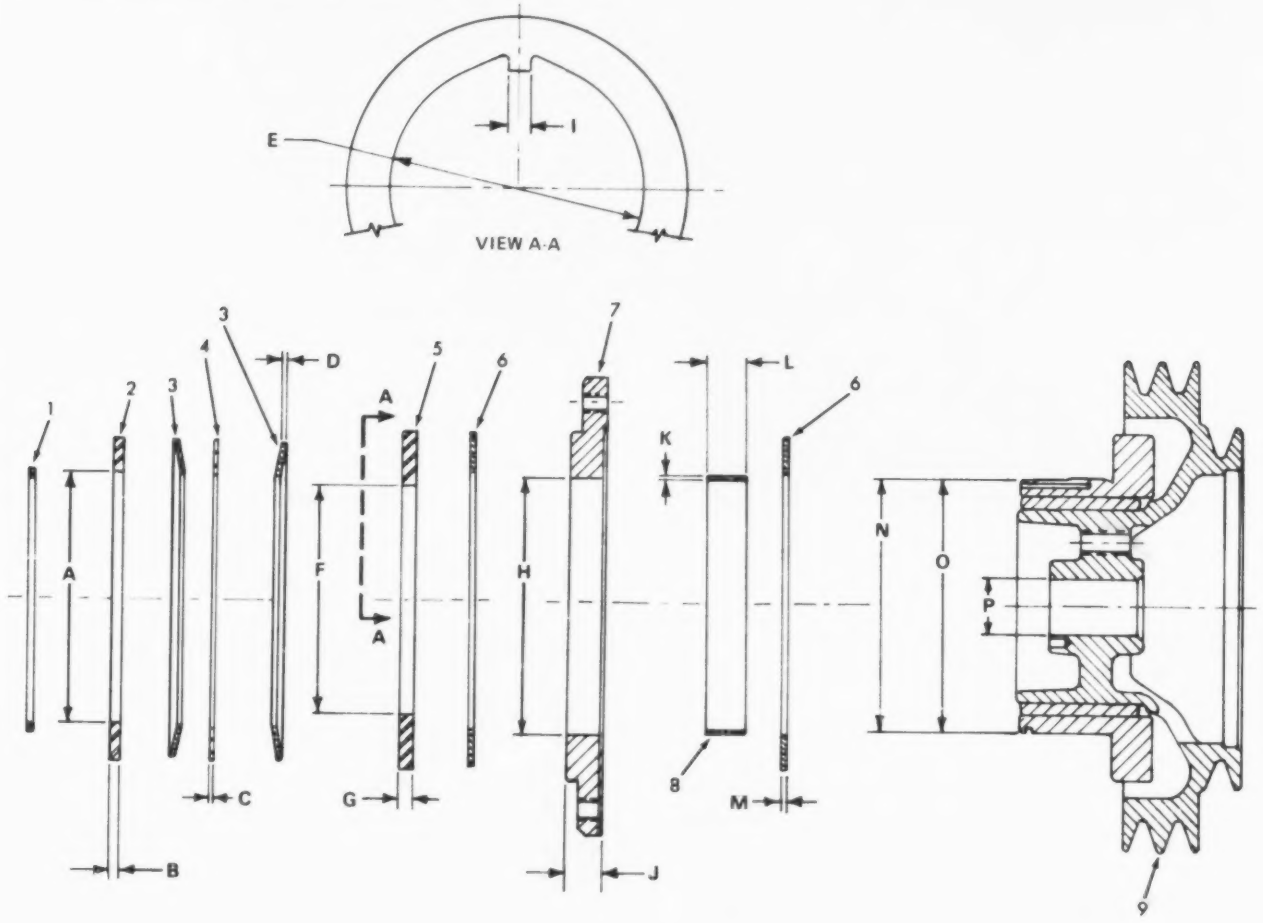



Fig. 8. Exploded View of Fan Mounting Assembly.

CE-114174

(Legend for Fig. 8)

1. Snap ring.
2. Spacer.
3. Belleville spring.
4. Belleville spacer.
5. Pressure plate.
6. Friction disc.
7. Mounting flange.
8. Friction bearing.
9. Pulley assembly.

A. 139.95-140.46 mm (5.510-5.530 inch) Dia.
B. 4.95-5.08 mm (0.195-0.200 inch).
C. 1.27-1.40 mm (0.050-0.055 inch).
D. 2.77 mm (0.109 inch) Ref.
E. 139.95-140.72 mm (5.510-5.540 inch) Dia.
F. 127.20-127.41 mm (5.008-5.016 inch) between tangs.
G. 7.874-7.938 mm (0.3100-0.3125 inch).
H. 143.10-143.15 mm (5.634-5.636 inch) Dia.
I. 12.57-12.62 mm (0.495-0.497 inch).
J. 17.336-17.463 mm (0.6825-0.6875 inch).
K. 1.50-1.65 mm (0.059-0.065 inch).
L. 22.23 mm (0.875 inch).
M. 3.05-3.30 mm (0.120-0.130 inch).
N. 139.62-139.67 mm (5.497-5.499 inch) Dia.
O. 139.50-139.67 mm (5.492-5.499 inch) Dia.
P. 28.562-28.580 mm (1.1245-1.1252 inch) Dia.

(see NOTE). Check the dimensions in more than one area and watch for unusual wear patterns.

**NOTE:** *The dimensional drawing is of the latest fan mounting assembly only. For earlier models, it is recommended that the parts be inspected for wear and replaced with new. For parts information, refer to the Parts Catalog.*

2. Check all parts for gouging caused by spinning against the mating part. Replace the part if worn beyond specification or gouged.

3. **For 560 Application Only:** Check the spacer (2, Fig. 8) for wear on the outside diameter of the front edge. If wear occurs, replace the spacer (2) and the fan spacer (Fig. 9).

4. Check belleville springs for bluing due to heat and replace if so.

5. Inspect the pressure plate tangs and the coupling flange keyways for pounding and wear. Replace if any wear has occurred beyond specifications.

**NOTE:** *(560 Only) If tangs show pounding, the fan spacer (Fig. 9) must also be checked for proper dimensions. The smaller I.D. must be 181.10-181.61 mm (7.130-7.150 inch).*

6. Replace the friction discs and friction bearing every time the fan mounting assembly is disassembled for service.

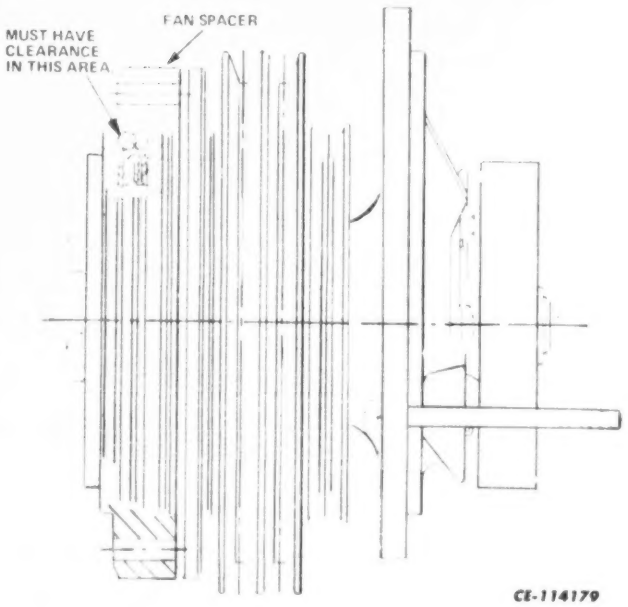



Fig. 9. Fan Spacer on 560.

7. Bluing of any part of the fan mounting assembly is a sign of excessive heat. This heat can weaken the bonding of the rubber member. Anytime this happens, the strength of the bonding must be checked by clamping the pulley in the holding fixture (Fig. 10), installing the torque fixture (Fig. 11) in the keyway of the coupling flange, and torquing to 2450-2700 N·m (1800-2000 lbf·ft). If any slippage occurs between the coupling and the pulley, the part must be replaced.

# FAN DRIVE HOUSING AND THERMOSTATS

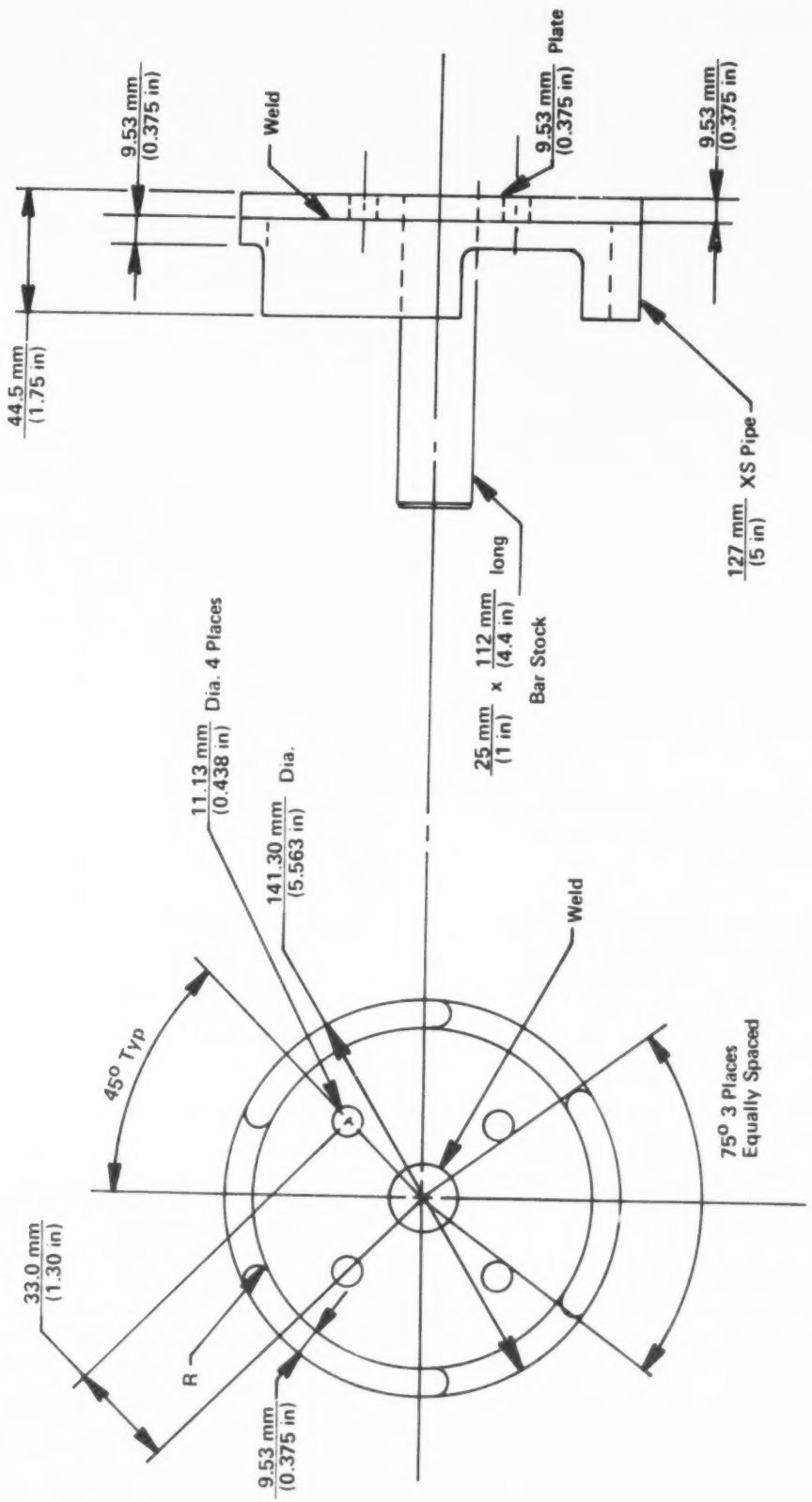

9.53 mm (0.375 in)
Weld
9.53 mm (0.375 in) Plate
9.53 mm (0.375 in)
44.5 mm (1.75 in)
127 mm (5 in) XS Pipe
25 mm (1 in) x 112 mm (4.4 in) long Bar Stock
11.13 mm (0.438 in) Dia. 4 Places
141.30 mm (5.563 in) Dia.
Weld
45° Typ
75° 3 Places Equally Spaced
33.0 mm (1.30 in)
R
9.53 mm (0.375 in)
CE-114177

Fig. 10. Fan Pulley Holding Fixture.

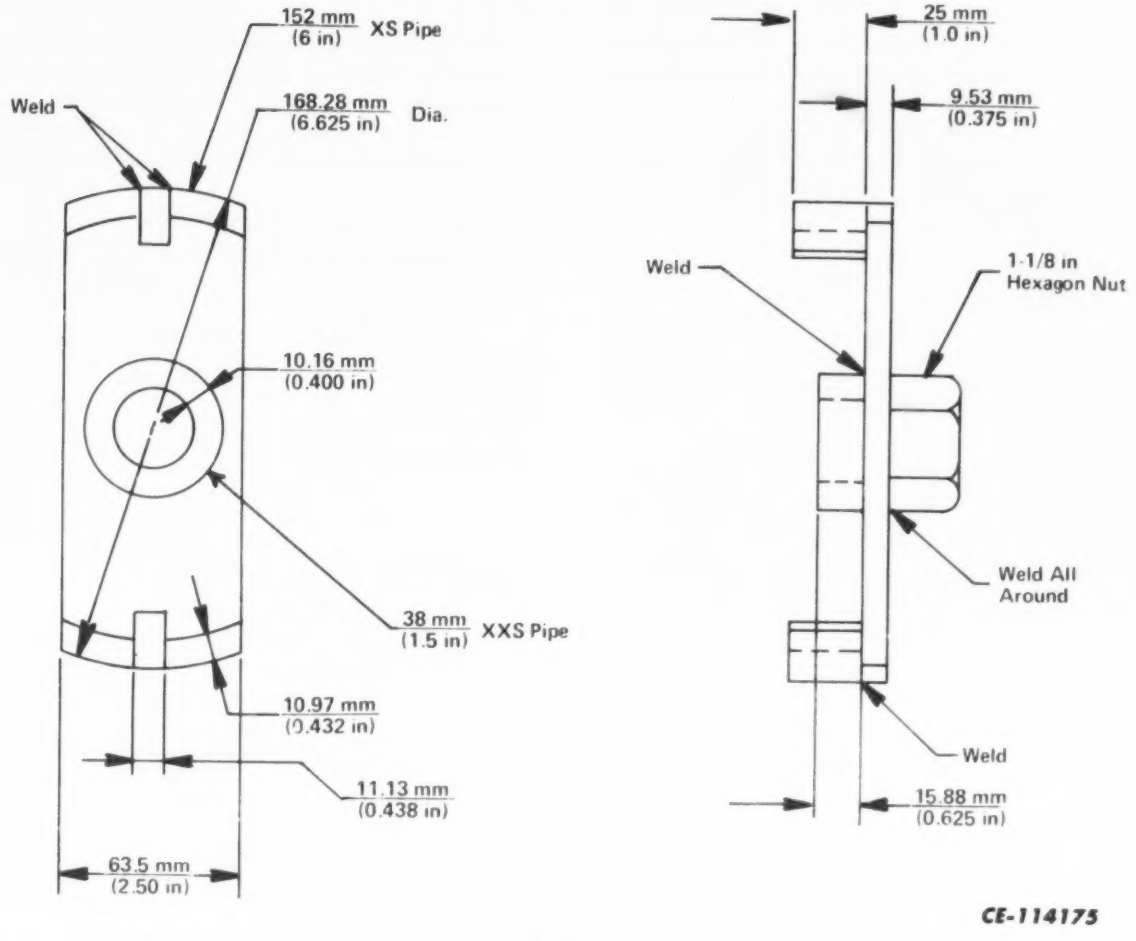



Fig. 11. Fan Pulley Torque Fixture.

## 9. REASSEMBLY OF FAN MOUNTING ASSEMBLY (Not used on 330/340 PAYhaulers)

1. Support the pulley and coupling assembly in a press using the coupling flange support tool (Fig. 5).

**NOTE:** *Make sure the support tool slips through the slots in the rear of the pulley and supports the coupling flange only; otherwise, damage will occur to the rubber member.*

2. Assemble the friction bearing inside one of the friction discs as shown (Fig. 12).

Fig. 12. Friction Disc and Friction Bearing Assembly.

# FAN DRIVE HOUSING AND THERMOSTATS

3. Slide the friction bearing and friction disc all the way on the coupling flange until the friction bearing is against the shoulder.

4. Slide the friction disc to the shoulder making sure the friction bearing stays inside of the friction disc (Fig. 13).

Fig. 13. Friction Bearing Installation.

5. Install the fan mounting flange over the friction bearing with fan pilot up.

6. Place the other friction disc over the end of the friction bearing.

7. Install the pressure plate. (See NOTE).

**NOTE:** *If the pressure plate tangs do not slide easily through the keyways, replace the pressure plate.*

8. Install one belleville spring concave side up (see NOTE). Refer to Fig. 9 for position of springs.

**NOTE:** *Use only the latest belleville springs when rebuilding the fan mounting assembly. Single belleville springs used on early model fan drives have different spring rates and do not compensate for friction disc wear causing premature failure.*

9. Install the belleville spacer (4, Fig. 8).

10. Install the other belleville spring concave side down.

**NOTE:** *Bellevilles must be installed opposing each other; otherwise, premature wear and failure of the friction discs will occur.*

11. Install the spacer (2, Fig. 8).

12. Place the snap ring installation tool (Fig. 14) over the fan mounting assembly as shown (Fig. 15).

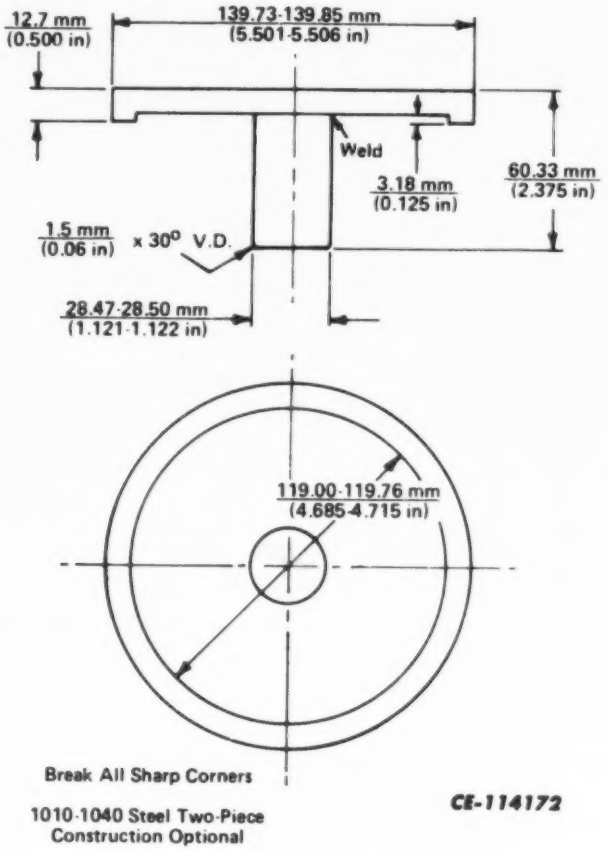



Fig. 14. Snap Ring Installation Tool.

13. Place the belleville spring compressor tool (Fig. 6) on top of the spacer (2, Fig. 8).

14. Compress the belleville springs and install the snap ring.

15. Check the fan mounting assembly slip torque as in "CHECKING FAN SLIP CLUTCH TORQUE WHEN REMOVED FROM ENGINE" Par. 6.

**NOTE:** *Torque will rise after running. Shims are no longer available or required to attain the proper torque. If the fan mounting assembly does not meet slip torque specifications, the belleville springs should be changed.*

**Fig. 15. Assembling Snap Ring Installation Tool.**

**NOTE:** *Burnishing by anyone other than the manufacturer is impossible due to the tools and fixtures required. Burnishing on a lathe in the field causes side loading which damages the friction bearing and friction discs and reduces clutch life.*

## 10. DISASSEMBLY OF THE HOUSING ASSEMBLY

1. Support the housing assembly by clamping the gear in a vise. Use soft, protective vise jaws being careful not to damage the gear.

2. Remove the hexagon jam nut from the shaft.

3. Remove the drive gear from the shaft with a gear puller as shown (Fig. 16).

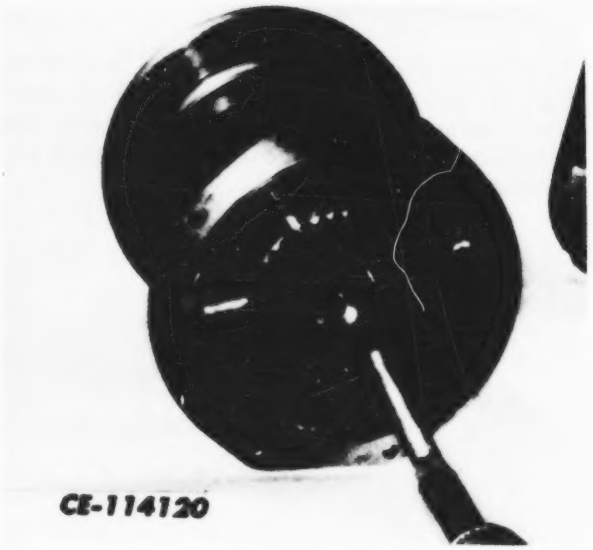



**Fig. 16. Removing Drive Gear.**

4. Remove the hex head bolts, bolt locks and bearing retainer plate from the housing.

5. Gently tap the front of the shaft to remove the shaft and ball bearings from the rear of the housing (see NOTE).

**NOTE:** *Do not force or damage will occur to the housing, bearings, and shaft.*

6. Remove the oil seal from the housing.

7. **560, H-100C and 330/340 Only**: Support the front side of the inner race of the front ball bearing and press the shaft out from the rear removing both bearings and the spacer.

7. **TD-25C Only**: Support the back side of the inner race (see NOTE) of the front ball bearing and press the shaft out from the front removing both the bearing and oil seal sleeve. Then support the front side of the rear ball bearing inner race (see NOTE) and press the shaft out from the rear.

**NOTE:** *Only support the bearings by the inner race. Do not press through the balls or damage will occur to the bearings.*

# FAN DRIVE HOUSING AND THERMOSTATS

## 11. INSPECTION AND REPAIR OF THE HOUSING ASSEMBLY

1. Refer to the dimensional drawings (Fig. 17 or Fig. 18) and replace any part that does not meet specifications (see NOTE). Always check the dimensions in more than one area and watch for unusual wear patterns.

NOTE: *Dimensional drawings are of latest housing assemblies only. For earlier models, it is recommended that the parts be inspected for wear and replaced with new. For parts information, refer to the Parts Catalog.*

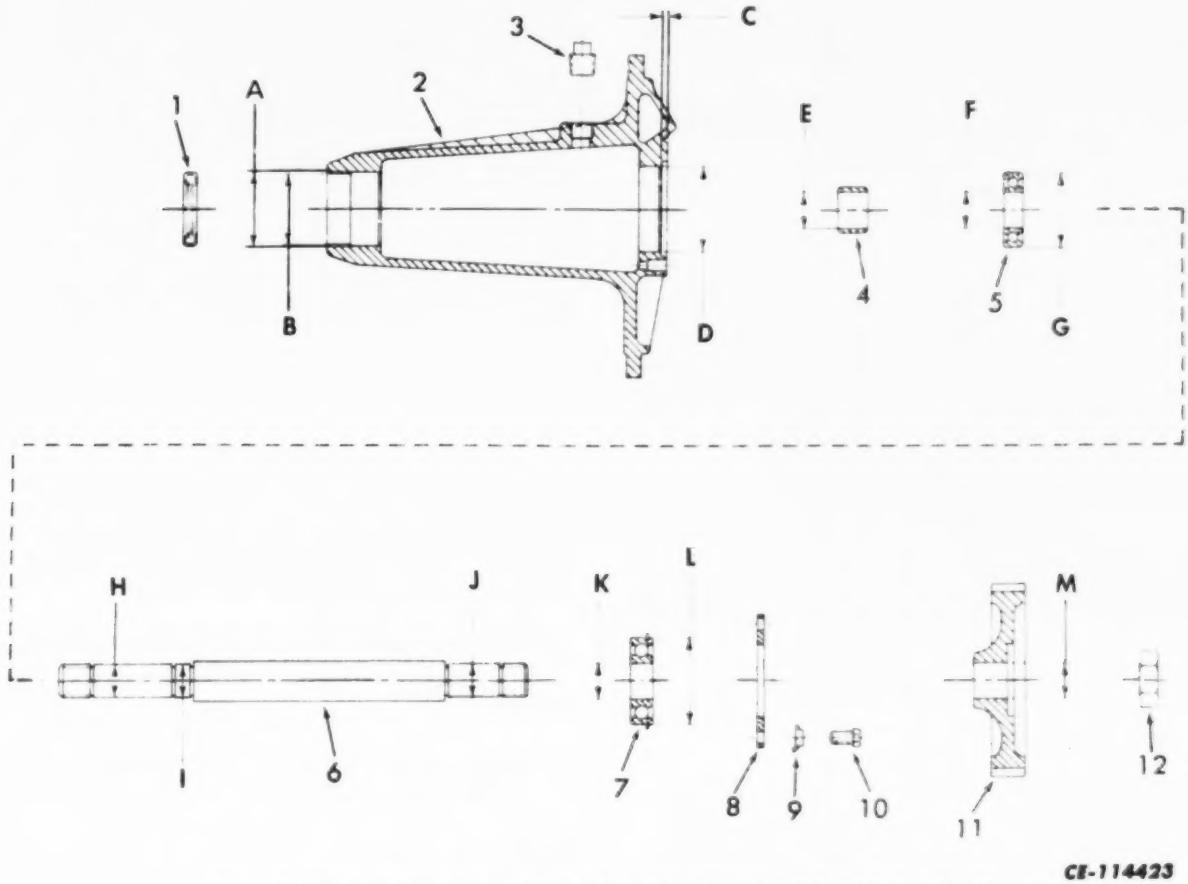



Fig. 17. Dimensional Drawing of Fan Housing for TD-25C Application.

1. Front seal.
2. Housing.
3. Plug.
4. Spacer.
5. Front bearing.
6. Shaft.
7. Rear bearing.
8. Retainer.
9. Lock.
10. Bolt.
11. Gear.
12. Nut.

A. 61.996-62.012 mm (2.4408-2.4414 inch) Dia.
B. 60.27-60.33 mm (2.373-2.375 inch) Dia.
C. 4.78-4.90 mm (0.188-0.193 inch).
D. 71.996-72.012 mm (2.8345-2.8351 inch) Dia.
E. 28.613-28.562 mm (1.1265-1.1245 inch) Dia.
F. 29.990-30.000 mm (1.1807-1.1811 inch) Dia.
G. 61.986-61.999 mm (2.4404-2.4409 inch) Dia.
H. 28.600-28.611 mm (1.1260-1.1264 inch) Dia.
I. 29.997-30.008 mm (1.1810-1.1814 inch) Dia.
J. 29.997-30.008 mm (1.1810-1.1814 inch) Dia.
K. 29.990-30.000 mm (1.1807-1.1811 inch) Dia.
L. 71.986-71.999 mm (2.8341-2.8346 inch) Dia.
M. 29.959-29.977 mm (1.1795-1.1802 inch) Dia.

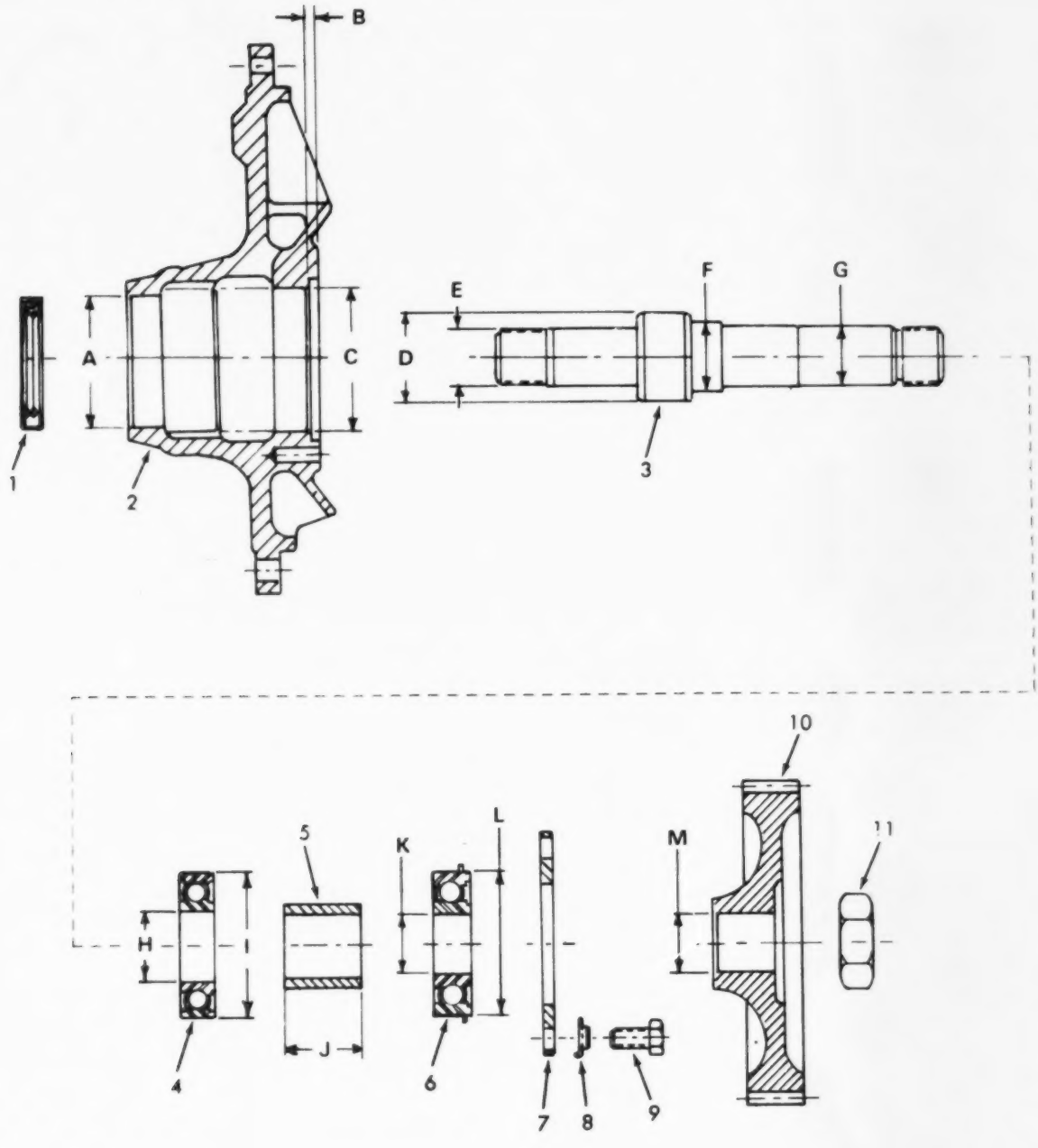



Fig. 18. Dimensional Drawing of Fan Housing.
(560 Shown; H-100C, 330/340 Similar).

# FAN DRIVE HOUSING AND THERMOSTATS

**Legend for Fig. 18**

1. Seal.
2. Housing.
3. Shaft.
4. Front bearing.
5. Spacer.
6. Rear bearing.
7. Retainer.
8. Lock.
9. Bolt.
10. Gear.
11. Nut.

A. 66.60-66.65 mm (2.622-2.624 inch) Dia.
B. 4.57-4.70 mm (0.180-0.185 inch).
C. 71.996-72.012 mm (2.8345-2.8351 inch) Dia.
D. 44.40-44.50 mm (1.748-1.752 inch) Dia.
E. 28.27-28.52 mm (1.113-1.123 inch) Dia.
F. 34.999-35.011 mm (1.3779-1.3784 inch) Dia.
G. 29.997-30.008 mm (1.1810-1.1814 inch) Dia.
H. 34.989-35.001 mm (1.3775-1.3780 inch) Dia.
I. 71.986-71.999 mm (2.8341-2.8346 inch) Dia.
J. 38.61-39.12 mm (1.520-1.540 inch).
K. 29.990-30.000 mm (1.1807-1.1811 inch) Dia.
L. 71.986-71.999 mm (2.8341-2.8346 inch) Dia.
M. 29.959-29.977 mm (1.1795-1.1802 inch) Dia.

2. Check all parts for gouging caused by spinning against the mating part. Replace the part if worn beyond specifications or gouged.

3. Check the drive gear for pitting and damaged teeth. Replace if so.

4. Inspect the shaft for damage due to the bearings turning or the gear turning on the shaft. Replace if worn beyond specifications.

5. Inspect the housing for damage from the bearings turning. Replace if damaged or worn beyond specifications.

6. Inspect the bearing retainer plate for wear from the ball bearing or any bending. Replace if damaged.

7. Oil seal should be replaced every time the drive is disassembled.

8. Replace the ball bearings every time the drive is serviced. Ball bearing damage can be hard to detect causing further damage later. Anytime unbalance has occurred in the fan mounting assembly, the ball bearings should be replaced due to possible damage.

NOTE: *Only use IH specified ball bearings. Bearings of similar code and size do not necessarily have equivalent capacities.*

## 12. REASSEMBLY OF HOUSING ASSEMBLY

NOTE: *Do not rebuild with any obsolete parts such as keyed shafts, keyed gears, and keyed mounting assemblies. Keyed shafts and gears were discontinued to prevent failures through keyways. Use only current part numbers or replace with current assemblies.*

1. **560, H-100C, 330/340 PAYhauler Applications Only:** Support the shaft by the front and press the front bearing, spacer and the rear bearing on (see NOTE).

NOTE: *Press only through the inner race of the ball bearings; otherwise damage will occur.*

1. **TD-25C Application Only:** Support the shaft by the front and press the rear ball bearing with the snap ring to the rear on until it bottoms on the shaft shoulder (Fig. 19).

2. **TD-25C Application Only:** Support the shaft by the rear and press the front ball bearing and oil seal sleeve on (see NOTE) until they bottom on the shaft shoulder (Fig. 20).

NOTE: *Press only through the inner race of the ball bearings; otherwise, damage will occur.*

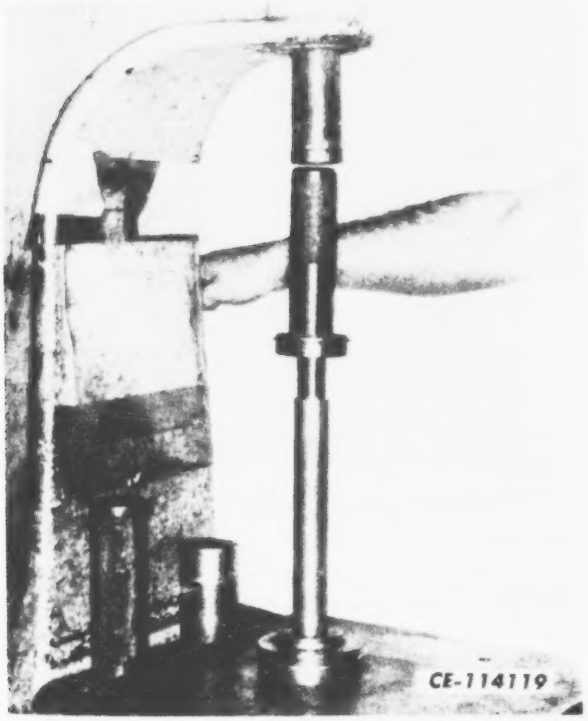



Fig. 19. Assembly of Rear Ball Bearing. (TD-25C)

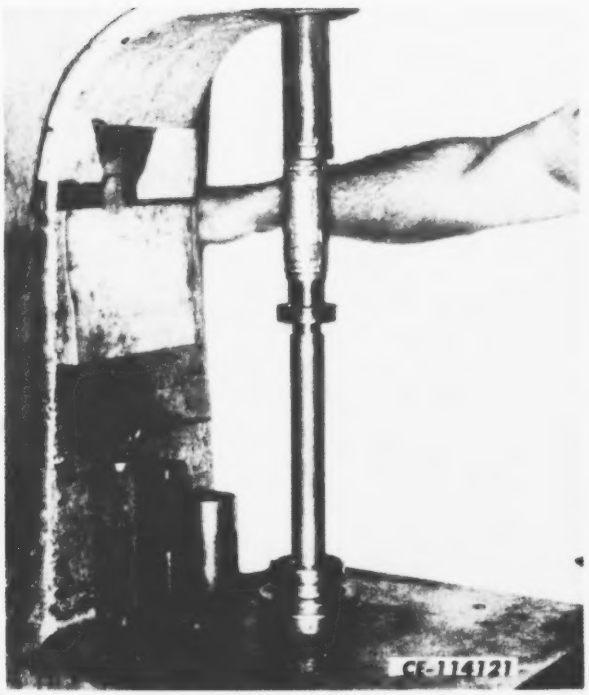



Fig. 20. Assembly of Front Ball Bearing and Oil Seal Sleeve (TD-25C).

3. Support the housing on a press and press the oil seal in flush with the front face.

4. Place an oil seal expanding sleeve over the front end of the shaft and install the shaft into the housing centering the bearings in the bores.

5. Press the bearings (see NOTE) in place (Fig. 21).

NOTE: *Press only through the outer race of the bearing or damage will occur.*

6. Install the bearing retainer plate, hex head bolts, and bolt locks. Torque the bolts to 33 N·m (24 lbf-ft).

7. Supporting the shaft in a press, position the gear in place and press onto the shaft until it bottoms on the rear bearing (Fig. 22).

8. Support the housing assembly by clamping the gear in a vise. Use soft, protective vise jaws being careful not to damage the gear.

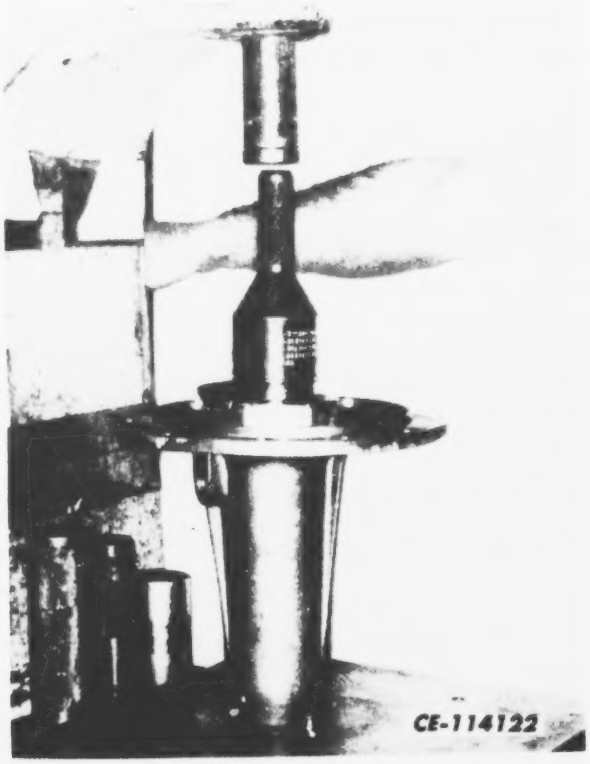



Fig. 21. Pressing Shaft and Bearing in the Housing (TD-25C Application Shown; Others Similar).

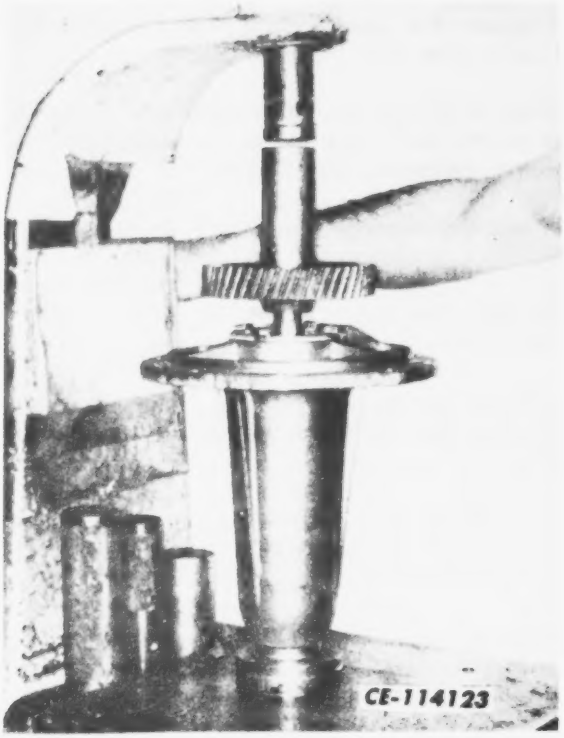



Fig. 22. Pressing Gear on the Shaft. (TD-25C Application Shown; Others Similar).

9. Install the hexagon jam nut (see NOTE) and torque to 815-845 N·m (600-625 lbf-ft).

NOTE: *Hexagonal jam nut torque is critical. The nut must be torqued to 815-845 N·m (600-625 lbf-ft) using a torque wrench. Insufficient torque will cause bearing slippage and excessive torque will cause bearing wear. DO NOT use an ESNA nut. The ESNA nut does not have the capacity for the higher torque.*

## 13. REASSEMBLY OF FAN DRIVE ASSEMBLY

NOTE: *Cleanliness of housing oil passageways and the gear is important to prevent damage to internal parts.*

1. **560 and H-100C Applications Only:** Insert the two hex head bolts and washers in the housing prior to assembly of the fan mounting assembly and the housing assembly as shown (Fig. 23).

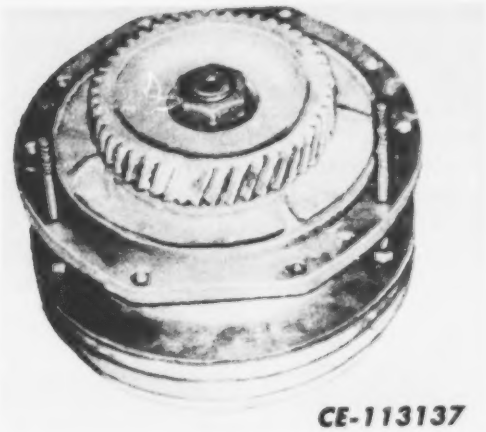



Fig. 23. Bolts Installed in Housing.

NOTE: *These two bolts cannot be removed when the fan mounting assembly is mounted on the fan housing assembly.*

2. While supporting the shaft and gear (Fig. 24), press the fan mounting assembly through the pulley onto the shaft until it bottoms on the shaft shoulder (see NOTE). The assembly must be installed so the pulley is towards the housing.

Fig. 24. Pressing on Fan Mounting Assembly (TD-25C Application Shown; Others Similar).

NOTE; *Shaft and gear must be supported to prevent damage to the ball bearings in the housing assembly.*

3. Support the fan drive assembly by clamping the gear in a vise. Use soft, protective vise jaws being careful not to damage the drive gear. Install and torque a new fan hub retaining ESNA nut (see NOTE) to 373-407 N·m (275-300 lbf-ft).

NOTE: *Do not reuse ESNA nut.*

### 14. INSTALLATION

NOTE: *Drive gear and rear face of housing assembly must be clear before installation to prevent damage to internal engine parts.*

1. Install the fan drive assembly and gasket onto the front cover with the raised boss in the proper position (Fig. 25). Refer to Reference Chart in Section 5, Par. 4.

2. Install the eight hex head bolts and nuts that secure the fan drive housing to the front cover.

3. Install the hub retainer plate (not used on 330 and 340 PAYhaulers) and secure with hex head bolts and new bolt locks. Bolt locks should not be reused.

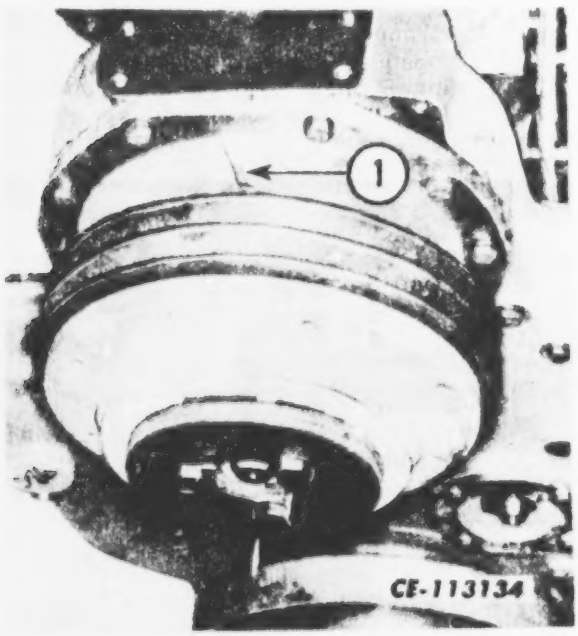



Fig. 25. Raised Boss on Fan Housing.

1. Boss.

4. Install and adjust the air compressor, alternator, and freon compressor belts (if equipped). Refer to Operator's Manual for adjustment procedure.

5. **560 Application Only:** Install the fan spacer with the fan pilot towards the front (see NOTE).

NOTE: *Check to make sure there is no interference between the fan spacer and the fan mounting assembly. If there is interference, replace the fan spacer.*

6. Install the fan onto the hub and secure it to the hub with the eight hex head bolts. Be sure the word "front" stamped on one of the fan blades is facing the front of the machine.

7. **TD-25C Application Only:** Remove the plug from the top of the fan drive housing and add one pint of engine oil of the type and viscosity being used in the crankcase.

## THERMOSTATS

### 15. MAINTENANCE

The thermostats can be checked by removing them and placing them in water. Place a thermometer in the water and heat the water. The thermostats should start to open at 82°C (180°F) and be fully open at 94°C (202°F) style A, Fig. 26 or 91°C (195°F) style B. Replace thermostats if they do not operate within this range.

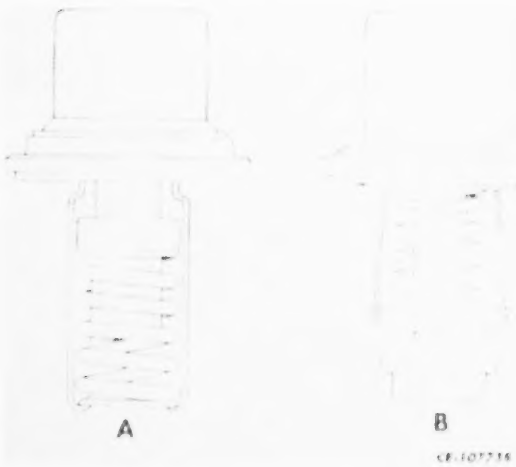



Fig. 26. Thermostat Identification

# FAN DRIVE HOUSING AND THERMOSTATS

## 16. REMOVAL AND DISASSEMBLY (Refer to Fig. 27)

1. Drain the cooling system.

2. Disconnect the water outlet and by-pass upper hose at the thermostat housing (1).

3. Remove the air compressor water inlet hose from the thermostat housing (if equipped).

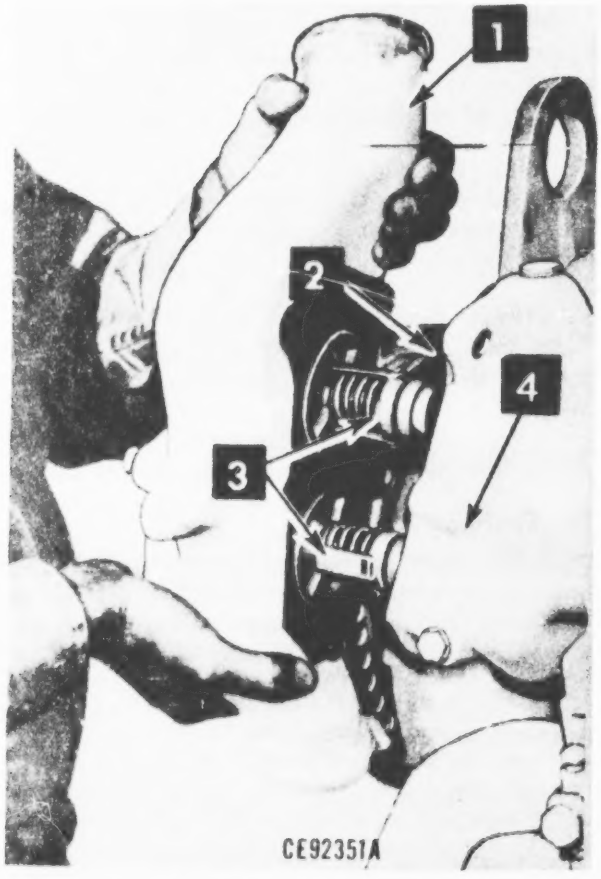



Fig. 27. Removing Thermostat Housing.

1. Thermostat Housing
2. Gasket
3. Thermostats
4. Water Manifold (front)

4. ALL APPLICATIONS EXCEPT TD-25C: Remove the alternator brace cap screw and washer from the thermostat housing.

5. Remove the thermostat housing (1) with thermostats (3) from the front water manifold (4). Remove the housing gasket (2) from the water manifold.

## 17. INSPECTION AND REPAIR

1. Clean all parts in solvent and dry with compressed air.

2. Inspect the thermostat housing for cracks and burrs, and replace if necessary.

3. Inspect the condition of the seals in the thermostat housing for hardness, cracks or wear and replace if necessary.

4. Check the thermostats as outlined in Par. 9.

## 18. REASSEMBLY AND INSTALLATION (Refer to Fig. 27)

1. If new thermostat seals are to be installed, position them in the thermostat housing with the lip of the seals facing down. The surface of the seal must be flush with the housing inner surface and parallel with the housing gasket surface.

2. Position the thermostat housing gasket (2) on the front water manifold and insert the thermostats (3) into the water manifold. Secure the thermostat housing (1) to the water manifold with the cap screws, nuts and washers.

3. Connect the air compressor water inlet hose to the thermostat housing (if equipped).

4. Connect the water outlet and by-pass upper hose to the thermostat housing (1).

5. ALL APPLICATIONS EXCEPT TD-25C: Secure the alternator brace to the thermostat housing with the cap screw and washer.

6. Fill and vent the cooling system as described in the Operator's Manual.

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

## LUBRICATING OIL AND WATER PUMP

### 1. DESCRIPTION

The lubricating oil, scavenging (see NOTE) and water pumps are all mounted on a common shaft that is driven by the gear train.

**NOTE:** *The scavenging pump is not used on late model 817C engines for 560 Pay loaders applications (Fig. 2).*

The lubricating oil pump picks up oil from the oil pan sump and delivers it to the engine oil cooler. The scavenging pump (if equipped) picks up the oil from the front of the oil pan and delivers it to the oil pan sump when the engine is working on angular operations.

The water pump circulates coolant through the oil coolers; then into the crankcase at the side between the number three and four cylinders.

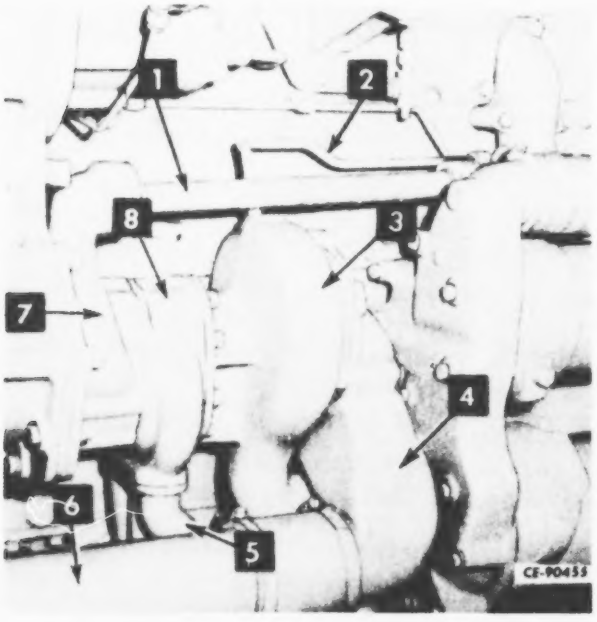



**Fig. 1. Lubricating Oil, Scavenging and Water Pump (TD-25 C Shown — Others Similar)**

1. Oil Pump Outlet Pipe
2. Water Pump Air Bleed Pipe
3. Water Pump
4. Water Inlet Elbow
5. Oil Scavenging Pump Manifold
6. Water Inlet Pipe
7. Oil Pump
8. Oil Scavenging Pump

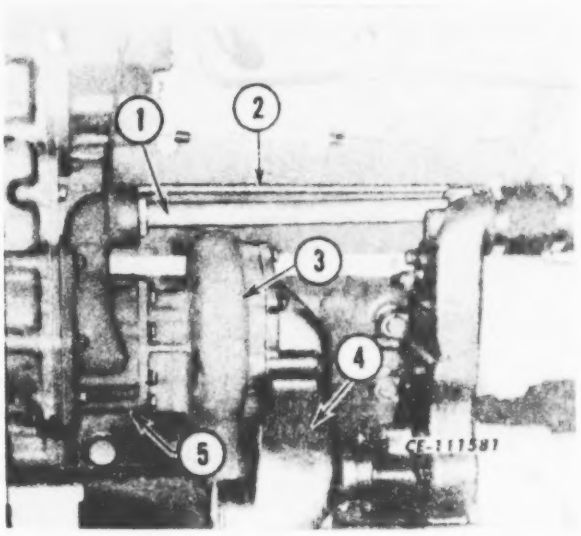



**Fig. 2. Lubricating Oil and Water Pump Without Scavenging Oil Pump**

1. Oil Pump Outlet Pipe
2. Water Pump Air Bleed Pipe
3. Water Pump
4. Water Inlet Elbow
5. Oil Pump

### 2. REMOVAL (Refer to Fig. 1)

1. Drain the cooling system.

2. If equipped with scavenging pump: Loosen the three cap screws holding the scavenging pump manifold in place. Slide the manifold from its position being sure not to damage the four "O" rings (Fig. 3).

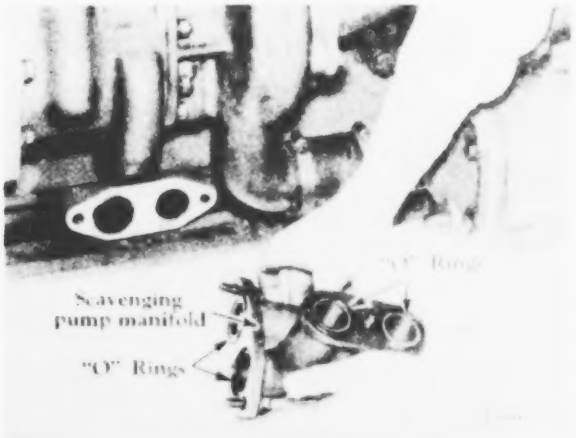



**Fig. 3. Removing Scavenging Pump Manifold**

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

3. Loosen the coupling nuts on each end of the oil pump outlet pipe (1) using a 12 point crowfoot wrench (Fig. 4). Slide the nuts back on the pipe and remove the pipe.

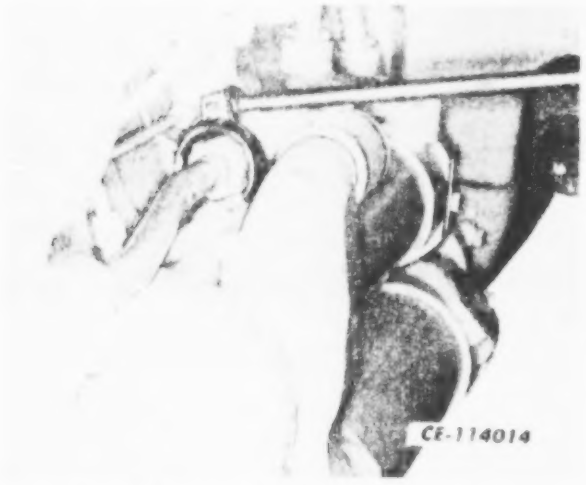



Fig. 4. Removing Oil Outlet Pipe Nut.

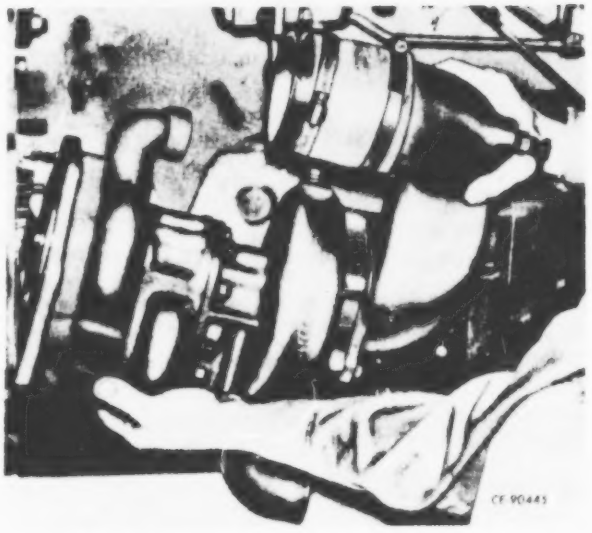



Fig. 5. Removing Oil and Water Pump.

4. Loosen the nut on the air bleed pipe (2) at the water pump housing.

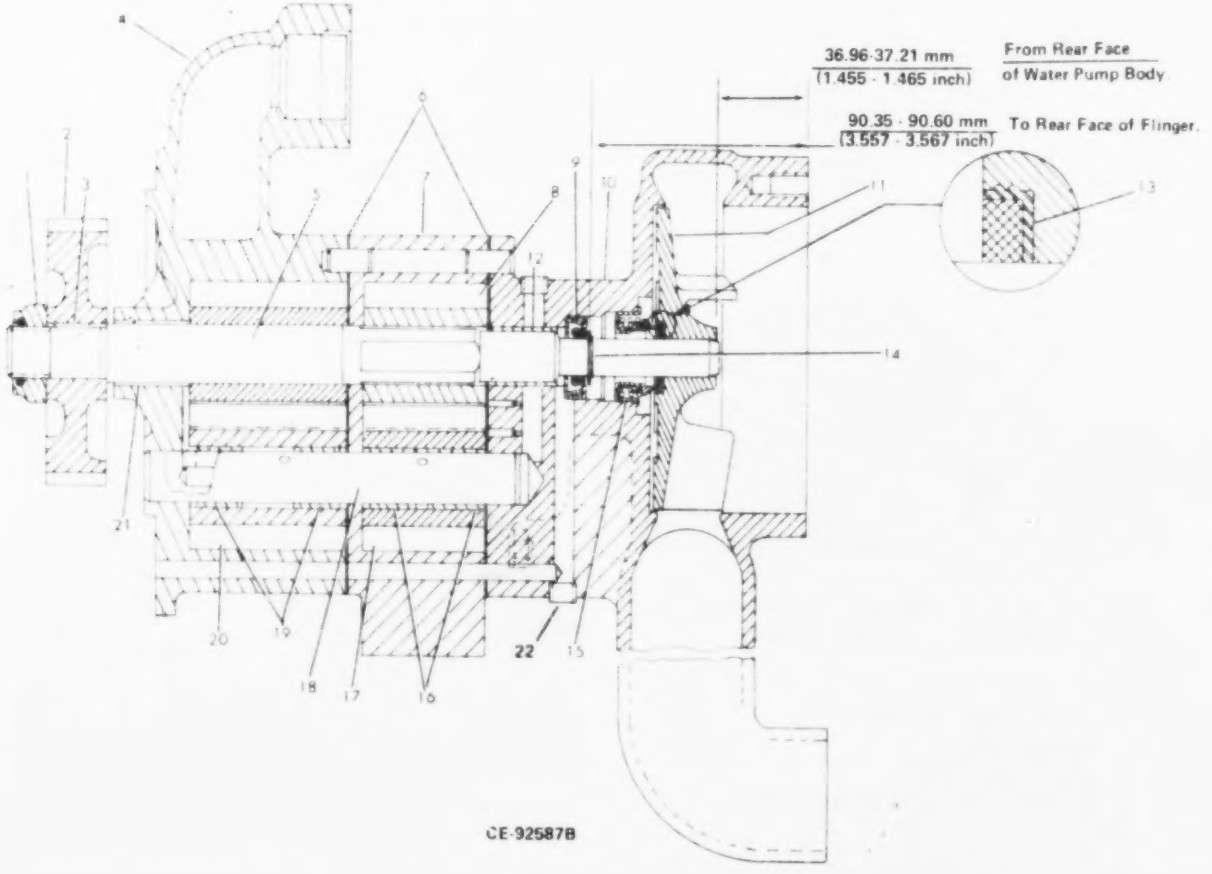



Fig. 6. Cross Sectional View of Oil, Scavenging and Water Pump.

**Legend for Fig. 6**

1. Nut
2. Drive Gear
3. Woodruff Key
4. Oil Pump Body
5. Oil and Water Pump Drive Shaft
6. Gaskets
7. Oil Scavenging Pump Body
8. Oil Scavenging Pump Body Gear
9. Water Pump Oil Seal
10. Water Pump Housing
11. Water Pump Impeller
12. Water Pump Body Bushing
13. Water Pump Seal Seat
14. Oil and Water Pump Drive Shaft Flinger
15. Water Pump Coolant Seal
16. Oil Scavenging Pump Idler Gear Bushing
17. Oil Scavenging Pump Idler Gear
18. Oil Pump Idler Shaft
19. Oil Pump Idler Gear Bushing
20. Oil Pump Body Idler Gear
21. Oil Pump Body Bushing
22. Seal Drain Hole

5. Remove the water inlet pipe (6) with hose from the water inlet elbow (4).

6. Loosen the hose clamps on the water pump outlet hose and slide the hose back onto the oil cooler inlet header.

7. Remove the cap screws and nuts securing the oil pump to the crankcase front plate and lift off the pump assemblies (Fig. 5).

### 3. DISASSEMBLY (Refer to Fig. 6)

1. Secure the oil and water pump assembly in a vise equipped with soft jaws and check the drive shaft end play (Fig. 7). (Refer to "SPECIFICATIONS" in Section 1). If the end play is not as specified, wear of one of the following is the probable cause:

   a. Oil and water pump drive shaft gear (width).

   b. Thrust faces of water pump body or oil scavenging pump body.

2. Re-position the oil and water pump assembly in the vise. Punch mark the inlet elbow-to-the water pump housing, and the oil scavenging pump (if equipped) or water pump body-to-the oil pump body (Fig. 8).

3. Remove the five cap screws and washers securing the inlet elbow to the water pump housing. Remove the inlet elbow and gasket.

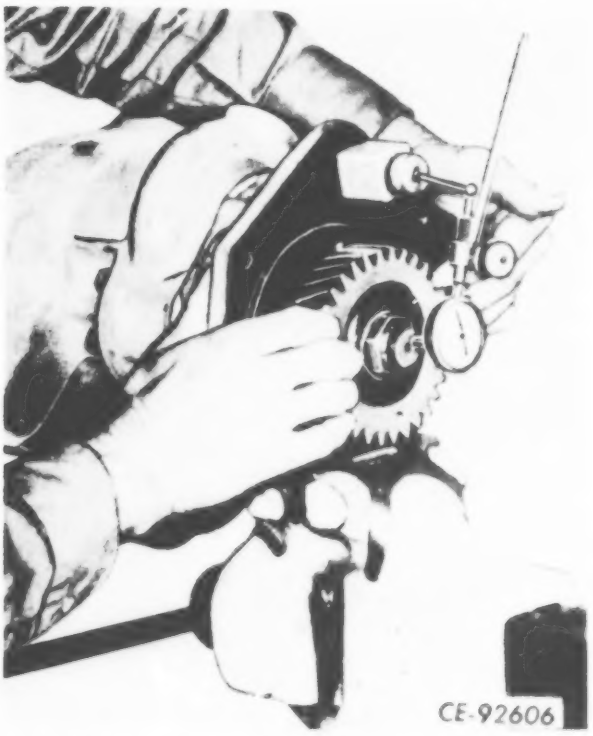



Fig. 7. Checking Drive Shaft End Play.

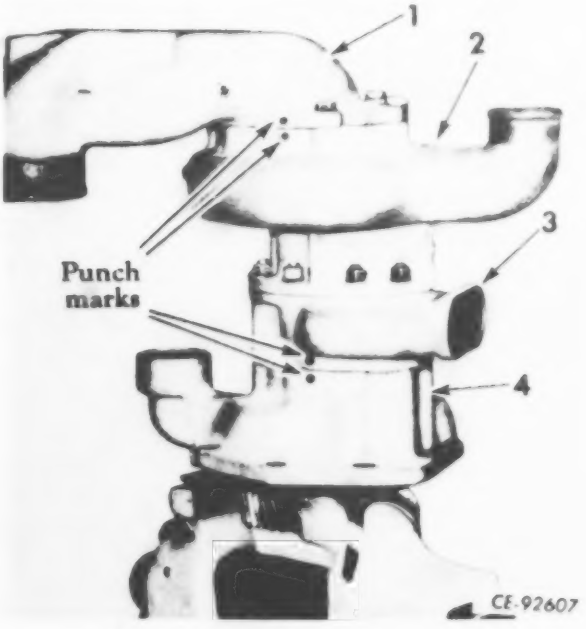



Fig. 8. Oil, Scavenging and Water Pump.

1. Inlet Elbow
2. Water Pump Body
3. Oil Scavenging Pump Body
4. Oil Pump Body

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

4. There are two 3/8 inch tapped holes in the face of the impeller which can be used as puller holes (see NOTE). Using a puller, as shown in Fig. 9, pull the impeller (11) off the shaft (5). The seal seat (13) will come out with the impeller.

**Fig. 9 . Removing Water Pump Impeller**

**Fig. 10. Removing Water Pump Housing**

**NOTE:** *Prior to installing puller, clean out the two tapped holes with a tap.*

5. Remove the eight nuts and lock washers securing the water pump housing (10). Remove the water pump housing and gasket (6) (Fig. 10).

6. Lift the coolant seal (15) out of the water pump housing.

7. Press the garter type oil seal (9) and oil finger (14) from the oil pump end of the water pump housing (Fig. 11).

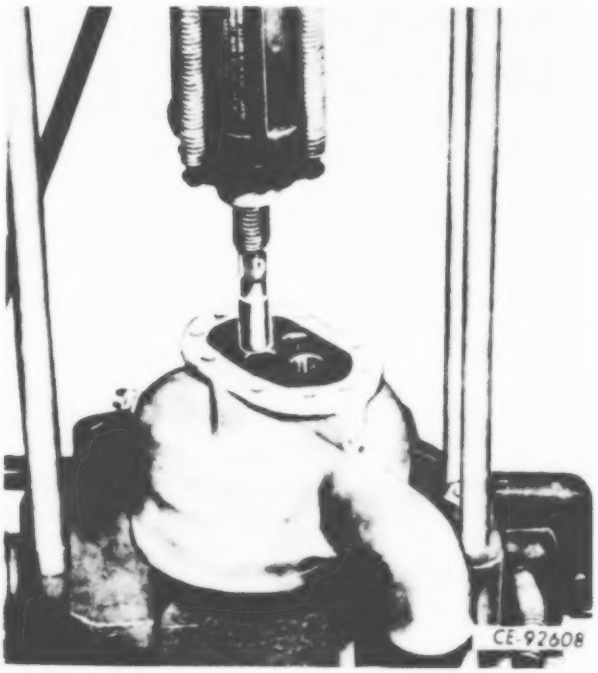



**Fig. 11. Pressing Oil Seal, Flinger and Retainer from Water Pump Housing**

8. If equipped with scavenging pump: Before any further disassembly of the oil and water pump, check the backlash between the scavenging pump body gear and idler gear (Fig. 12), and radial clearance between the gears and body (Fig. 13) to determine if gears or body need replacement. (Refer to "SPECIFICATIONS" in Section 1).

9. If equipped with scavenging pump: Mark the scavenging pump gears (8 and 17), as shown in Fig. 14, with an India oilstone or small pieces of tape for proper reassembly. Remove the gears. The reason for this is to re-establish the same gear tooth wear pattern when the original gears are to be reinstalled. The efficiency of the pump may otherwise be impaired. Keep the scavenging gears separate for reassembly.

Fig. 12. Checking Backlash (Scavenging Pump Body and Idler Gears Shown; Oil Pump Idler and Body Gears Similar)

Fig. 13. Checking Clearance Between Gears and Housing

Fig. 14. Removing Scavenging Pump Gears

10. If equipped with scavenging pump: Remove the scavenging pump body (7) from the oil pump body (4) (Fig. 15).

Fig. 15. Removing Scavenging Pump Body

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

11. Check the backlash between the oil pump body gear and idler gear (refer to Fig. 12), and radial clearance between the gears and oil pump body (refer to Fig. 13) to determine if gears or pump body need replacement. (Refer to "SPECIFICATIONS" in Section 1.)

12. Mark the oil pump body gear and the idler gear (20) in the same way as the scavenging pump gears, as outlined in Step 9. Remove the idler gear (20) from the idler shaft (18).

13. Re-position the oil pump in the vise and remove the drive gear nut (1) from the drive shaft (5) (Fig. 16).

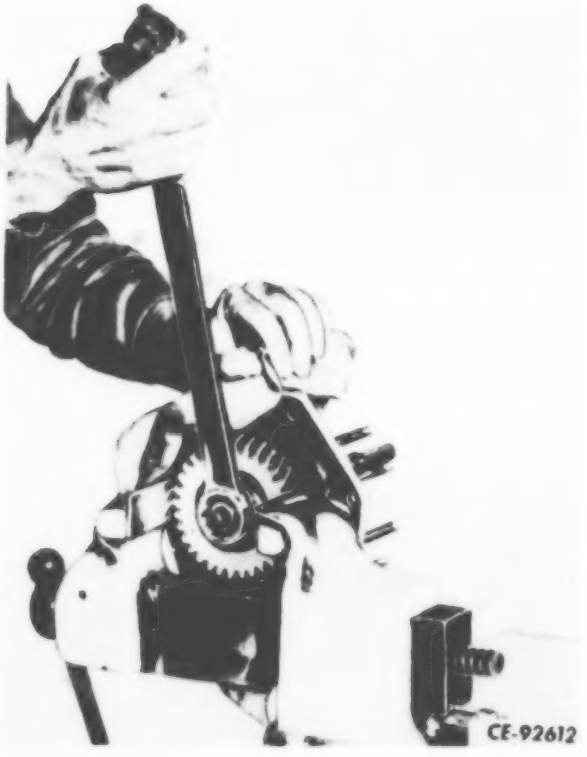



**Fig. 16. Removing Drive Gear Nut**

14. Using a gear puller, push the drive shaft (5) out of the gear (2) (Fig. 17). Remove gear and Woodruff key (3).

15. Remove the drive shaft (5) with oil pump body gear from the body.

16. If necessary, drive or press the idler shaft (18) from the body (Fig. 18).

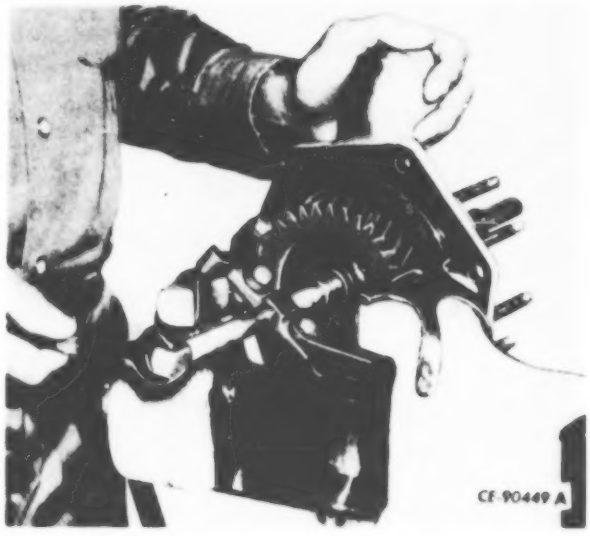



**Fig. 17. Pushing Drive Shaft Out of Drive Gear**

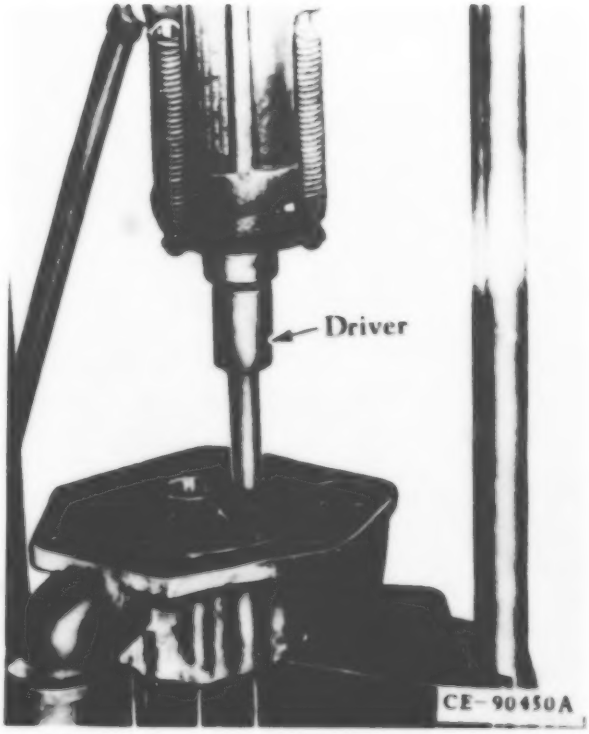



**Fig. 18. Removing Idler Shaft**

## 4. INSPECTION AND REPAIR

1. Wash all metal parts thoroughly in solvent and dry with compressed air. Be sure that the idler shaft and oil pump body oil holes and drilled passages are clean and open. Check the drain holes (22, Fig. 6) in the water pump body. Remove dirt or sludge from the water pump seal drain hole. Inspect all pipes and hoses for damage and replace if necessary. Check for excess pitting, rust and thrust or contact wear on all parts.

2. Inspect all gears for wear, scoring and chipped teeth. Stone the faces and edges of the gear teeth to remove any nicks or burrs.

3. Using a micrometer, check the width of the gears (Fig. 19). (Refer to "SPECIFICATONS" in Section 1.) When a gear is found to be damaged, it must be replaced, including the mating gear. If the oil pump body gear or drive shaft is found to be unserviceable, both will have to be replaced.

**Fig. 19. Checking Gear Width**

4. Inspect the bushings in the water and oil pump housings and the two bushings in the oil pump idler gear with a hole gauge and micrometer (Fig. 20) for wear and out-of-roundness. (Refer to "SPECIFICATIONS" in Section 1.) If replacement is necessary, the water and oil pump housing bushings must be installed until they are flush to 0.38mm (0.015 in.) below the front surface of the housing. The idler gear bushings must be installed in each end of the gear until they are approximately 1/8 inch below the edge of the gear.

**Fig. 20. Checking Bushings**

5. Using a micrometer check the drive shaft and idler shaft diameters (Fig. 21). (Refer to "SPECIFICATIONS" in Section 1.)

**Fig. 21. Checking Drive Shaft and Idler Shaft**

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

6. Examine the water pump impeller contact surfaces for evidence of wear or grooving. Inspect the impeller vanes, remove any nicks, burrs and roughness, particularly around the edges.

7. Inspect the oil scavenging pump manifold (if equipped) and "O" rings. It is also recommended that the oil pan be removed and the oil pick up tube be pressure checked for leaks.

## 5. REASSEMBLY (Refer to Fig. 6)

1. Position the idler shaft (18) in the oil pump body (4), so that the oil holes in the shaft are in line with the oil slot in the body. Press or drive the shaft into the body until the lower oil hole in the shaft is indexed with the slot as shown in Fig. 22.

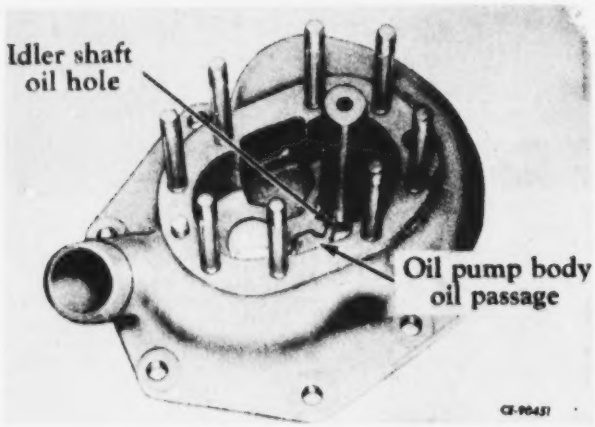



**Fig. 22. Installing Idler Shaft**

2. Install the drive shaft (5) with body gear into the oil pump body (4).

3. Install the Woodruff key (3) in the slot of the drive shaft (5) and press the drive gear (2) onto the shaft until it bottoms on the shoulder of the shaft. Install the drive gear nut (1) and torque to 190 N.m (140 ft-lbs).

4. Install the idler gear (20) with bushings (19) (lubricated with clean engine oil) on the idler shaft (18), so that the marks on the two gears made previously line up.

5. If equipped with scavenging pump: Using a new gasket (6), install the scavenging pump body (7) to the oil pump body with the scavenging ports facing away from the outlet elbow (Fig. 23).

6. If equipped with scavenging pump: Install the scavenging pump gears (8 and 17) into the body being sure to line up the marks previously made.

7. Install a new garter type oil seal (9) into the water pump housing with the lips facing down. Using a driver slightly smaller in diameter than the OD of the

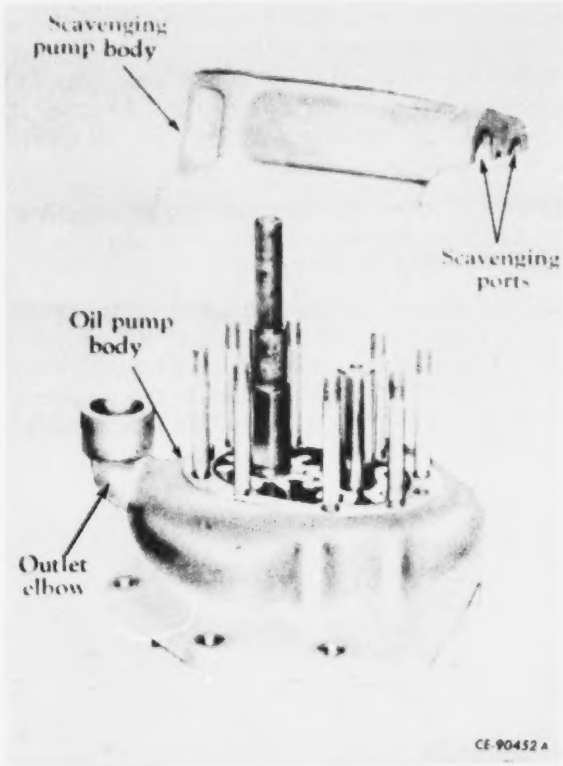



**Fig. 23. Installing Scavenging Housing on Oil Pump Housing**

**Fig. 24. Installing Garter Type Oil Seal**

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seal, drive the seal down 27mm (1-1/16 in.) below the inner machine surface of the water pump housing (Fig. 24).

**NOTE:** *Do not press the seal down beyond the 27mm (1-1/16 in.) dimension. To do so will block an internal oil return passage in the housing. Use new oil seals on all rebuilds, as the old seal is damaged on removal.*

8. Using a new gasket (6), install the water pump housing. Caution must be used to prevent folding under of the garter type seal.

9. Tighten the water pump hold down nuts to 36 N·m (26 ft-lbs) torque.

10. Position the flinger (14) on the drive shaft so that the small OD of the flinger is facing out from the water pump housing. Tap the flinger into position on the shaft until a measurement of 90.35-90.60mm (3.557-3.567 in.) is obtained from the water pump housing rear face to the rear face of the flinger (Fig. 6).

11. Install the new coolant seal assembly (15) over the shaft to bottom on the shoulder in the pump housing (Fig. 6).

12. Moisten the new seat (13) with water and install it into the groove of the impeller (11) as shown in Fig. 6.

13. Press or drive the impeller on the drive shaft 36.70-37.21mm (1.445-1.465 in.) (Fig. 6) measuring from the water pump housing rear face and the machined surface on the impeller (Fig. 25).

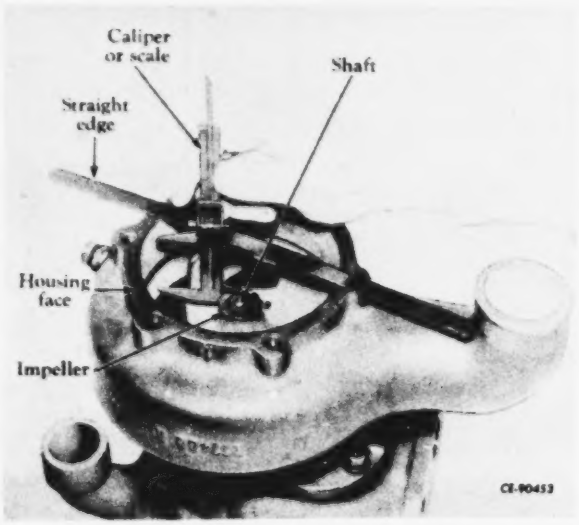



**Fig. 25. Checking Measurement Between Water Pump Housing Rear Face and Impeller**

14. Rotate the pump drive gear. If the impeller is rubbing on the water pump housing, recheck the position of the impeller as described in Step 13.

15. Install the water pump inlet elbow and gasket on the water pump housing.

### 6. INSTALLATION

1. Install the oil and water pump. Tighten the mounting cap screws and nut (Fig. 5) to 52 N.m (38 ft-lbs) torque.

**NOTE:** *An oil pump that is completely dry, such as a new or rebuilt pump, must operate at excessive engine speeds to prime. To avoid possible engine oil pump, turbocharger or engine damage from an initial lack of lubrication , the oil pump must be primed before starting an engine which (1) has been lying on its side during an overhaul or (2) has had its oil pump replaced or rebuilt. Prime the pump by pouring 1/4 l (1/2 pint) of engine oil into the oil pump outlet elbow.*

2. Install the oil pump outlet pipe and tighten the coupling nuts on each end using a 12 point crowfoot wrench (Fig. 4).

3. Reconnect the air bleed pipe to the water pump housing (Fig. 1).

4. Install the water inlet pipe and hose to the water inlet elbow and tighten the hose clamps (Fig. 1).

5. Slide the outlet hose onto the water pump housing water outlet and tighten the hose clamps.

6. If equipped with scavenging pump: Install the scavenging pump manifold by sliding it into position and installing the three cap screws. Be sure not to damage the "O" rings (Fig. 3).

7. Fill the cooling system and check for leaks when the unit is in operation.

## LUBRICATING OIL FILTERS

### 7. DESCRIPTION

The purpose of the lubricating oil filters is to separate and remove the dirt and other foreign substances from the engine oil, and to prevent these injurious materials from being circulated to the engine.

These engines are equipped with full-flow (element or spin-on type) lubricating oil filters. These filters have the no-drain-back feature which eliminates the necessity of pumping the oil up into the filters when starting the engine.

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

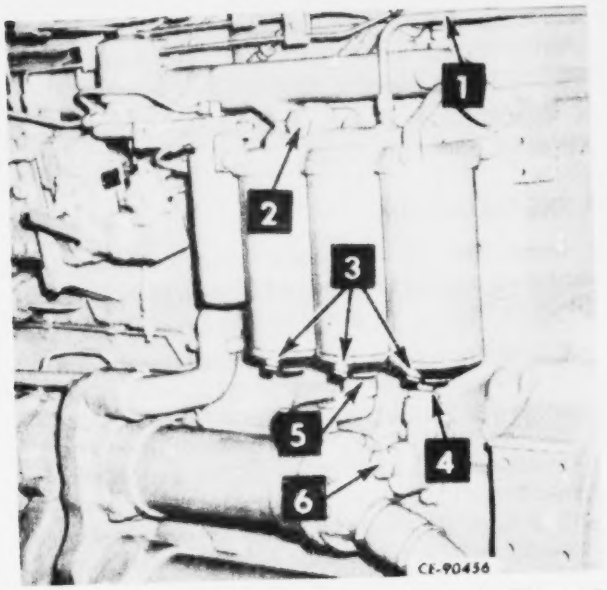



**Fig. 26. Lubricating Oil Filter Removal (Element Type)**

1. Turboc ger Oil Supply Tube
2. By-Pass valve
3. Filter Case Drain Plugs
4. Filter Oil Outlet Pipe
5. Filter Oil Inlet Pipe
6. Pressure Regulating Valve

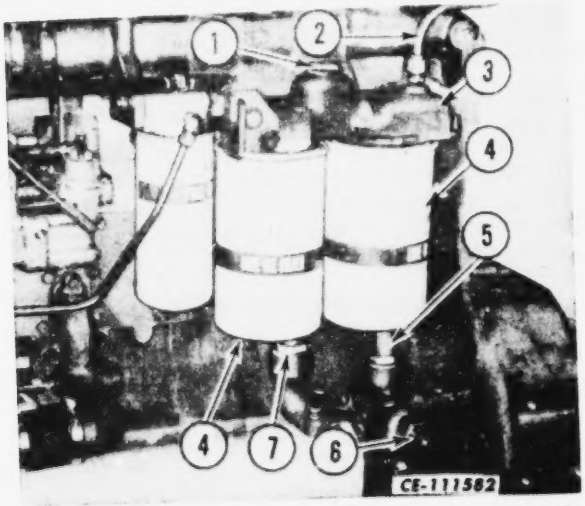



**Fig. 27. Lubricating Oil Filter Removal (Spin-On Type)**

1. By-Pass Valve
2. Turbocharger Oil Supply Tube
3. Oil Filter Header
4. Oil Filters
5. Filter Oil Outlet Pipe
6. Pressure Regulating Valve
7. Filter Oil Inlet Pipe

A by-pass valve (2, Fig. 26) or (1, Fig. 27) is located in the oil filter head. The oil pressure regulating valve (6, Figs. 25 or 26), which maintains a pressure of 303-359 kPa (44-52 psi), is located in its own housing on the outside of the engine crankcase and is connected to the filter assembly by an oil line.

The filter assembly is located on the left side of the engine.

## 8. REMOVAL AND DISASSEMBLY

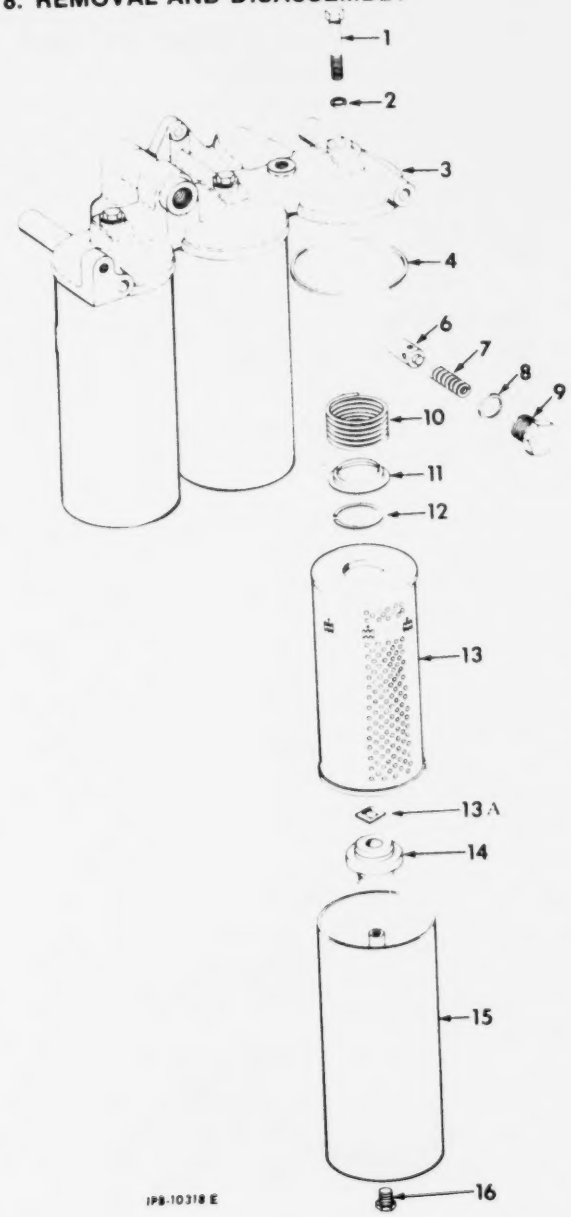



**Fig. 28. Lubricating Oil Filters (Element Type)**

**Legend for Fig. 28**

1. Retainer Bolt
2. Washer
3. Head
4. Case Gasket
6. By-Pass Valve
7. Spring
8. Gasket
9. Nut
10. Spring
11. Retainer
12. Retainer Ring
13. Filter Element
13A. Spring Nut
14. Lower Guide and Seat
15. Filter Case
16. Plug

**Element Type (Refer to Fig. 28)**

1. Remove the filter case drain plugs and drain the oil from the cases.

2. Remove the retainer bolts (1) with washers (2) from the filter head and remove the three filter cases (15). Discard the case gaskets (4).

3. Lift the elements (13) out of the cases.

**Fig. 29. Removing Pressure Regulating Valve**

4. Remove the retainer ring (12) from the upper guide and remove the retainer (11) and spring (10).

5. Remove the spring nut (13A) from the stud in each of the cases. Remove the guide and seat (14) from each case.

6. Remove the by-pass valve nut (9), gasket (8), spring (7) and valve (6) from the filter head (3).

7. Remove the pressure regulating valve nut, spring and valve (Fig. 29).

8. Loosen the filter oil inlet and outlet pipe nuts (Fig. 26) from both ends of the pipes. Disconnect the turbocharger oil supply line from filter header.

9. Remove the three cap screws securing the filter head to the cylinder head. Remove the filter header.

**NOTE:** *It will be necessary to push the oil inlet and outlet pipes up into the filter head as far as possible to enable the head to be removed from under the water manifold.*

**Spin-On Type (Refer to Fig. 30)**

**NOTE:** *These filters cannot be cleaned and should not be disturbed except when it becomes necessary to replace them.*

1. Clean the outside of the filters to prevent dirt from entering the system while servicing.

2. Remove the spin-on filters (1) by turning them counterclockwise. Discard the filters.

3. Remove the by-pass valve nut (7), gasket (6), spring (5) and valve (4) from the filter header (3).

4. Remove the pressure regulating valve nut, spring and valve (Fig. 29).

5. Loosen the nuts from both ends of the filter oil outlet pipe (5, Fig. 27) and inlet pipe (7). Disconnect the turbocharger oil supply line from filter header.

6. Remove the cap screws securing the filter head (3, Fig. 30) to the cylinder head. Remove the filter head.

**NOTE:** *It will be necessary to push the oil inlet and outlet pipes up into the filter head as far as possible to enable the head to be removed from under the water manifold.*

**9. INSPECTION AND REPAIR**

1. Clean the filter head and all other parts thoroughly with solvent.

2. Flush out the oil inlet and outlet pipes and clean the pressure regulating valve housing.

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

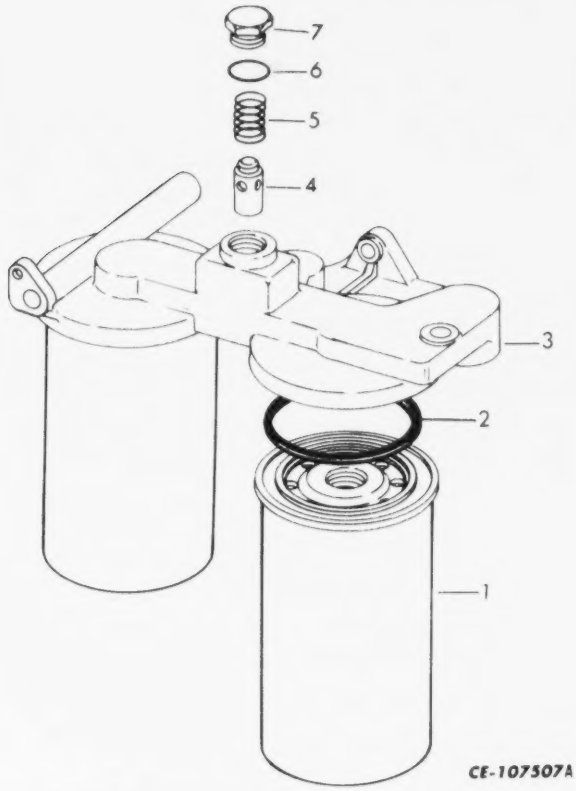



**Fig. 30. Lubricating Oil Filters (Spin-On Type)**

1. Oil Filter.
2. Gasket.
3. Oil Filter Header.
4. By-Pass Valve.
5. Spring.
6. Gasket.
7. Nut.

3. Check the pressure regulating valve spring and by-pass valve spring for proper length, action and condition. For the specified free length, test load and test length, refer to "SPECIFICATIONS" in Section 1. A valve spring outside of these standards must be replaced.

4. The outside diameter of the pressure regulating valve is 18.97-19.00 mm (0.747-0.748 in); the valve bore is 19.05-19.10 mm (0.750-0.752 in); the running clearance is 0.05-0.13 mm (0.002-0.005 in).

5. ELEMENT TYPE FILTERS: The outside diameter of the by-pass valve is 18.97-19.00 mm (0.747-0.748 in); the valve bore is 19.05-19.10 mm (0.750-0.752 in); the running clearance is 0.05-0.13 mm (0.002-0.005 in).

SPIN-ON TYPE FILTERS: The outside diameter of the by-pass valve is 15.80-15.82 mm (0.622-0.623 in); the valve bore is 15.85-15.88 mm (0.624-0.625 in); the running clearance is 0.02-0.08 mm (0.001-0.003 in).

6. Be sure that the valves are in good condition, that they slide freely, and that the valve seats in the housing and filter head are not damaged.

7. Check the seal rings on the oil outlet and inlet pipes to be sure they are in good condition. Replace if necessary.

## 10. REASSEMBLY AND INSTALLATION

**Element Type (Refer to Fig. 28)**

1. Install the filter head with the oil inlet and outlet pipes to the engine. Secure the pipes at both ends with the coupling nuts and install and tighten the three filter head mounting cap screws.

2. Connect the turbocharger oil supply line to the filter header.

3. Install the by-pass valve (6), spring (7), washer (8) and nut (9) into the housing of the filter head (3). Be sure that the spring does not cock the valve in the housing.

4. Install the pressure regulating valve, spring and nut in its housing in the same manner as the by-pass valve (Fig. 29).

5. Install the springs (10), retainers (11) and retainer rings (12) onto the upper guides.

**NOTE:** *Make sure that the filter retainers are free and up against the retainer rings, if not reposition them (Fig. 31). If not positioned correctly they will cause lubricating oil to bypass the filters allowing unfiltered oil to enter the engine lubrication system.*

6. Install new gaskets (4) into the filter head.

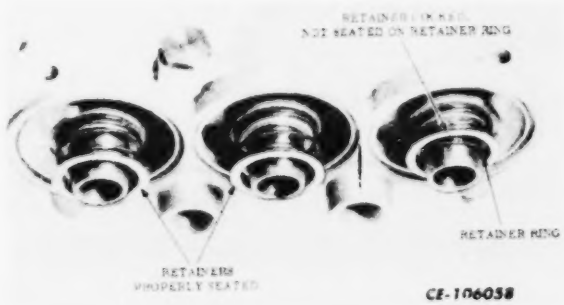



**Fig. 31. Example of Improperly Seated Filter Retainer**

7. Install the lower guide and seats (14) into the filter cases (15). Install the spring nut (13A) over the case stud and down tight against the lower guide and seat in each case.

8. Install a new filter element (13) into each case.

9. Install the plug (16) into each case. Fill each case with oil. Refer to the Operator's Manual for the specified type and amount of lubricant to use.

10. Position each filter case in the filter head (3), and using a new washer (2), install and tighten the retainer bolts (1) to 27 N.m (20 ft-lbs) torque.

11. Check for leaks when the unit is in operation.

**Spin-On Type (Refer to Fig. 30)**

1. Install the filter head (3) with the oil inlet and outlet pipes to the engine. Secure the pipes at both ends with the coupling nuts and install and tighten the filter head mounting cap screws.

2. Connect the turbocharger oil supply line to the filter header.

3. Install the by-pass valve (4), spring (5), gasket (6) and nut (7) into the housing of the filter head (3). Be sure that the spring does not cock the valve in the housing.

4. Install the pressure regulating valve, spring and nut in its housing (Fig. 29) in the same manner as the by-pass valve.

5. Install new filters by applying a light coat of engine oil to the gasket and thread the filters on one full turn after gasket contacts base.

6. Refer to the Operator's Manual for amount, type and grade of oil used.

7. Check for leaks when the unit is in operation.

## OIL COOLERS

### 11. DESCRIPTION

The oil cooler for the engine and the oil cooler for the torque converter (if equipped) are mounted on the left side of the engine. All of the engine oil is circulated from the crankcase through the cooler and into the oil filters. Water flows through both the engine oil cooler and torque converter oil cooler simultaneously and in the same direction.

### 12. REMOVAL (Refer to Fig. 32)

1. Drain the cooling system, oil filters and oil coolers.

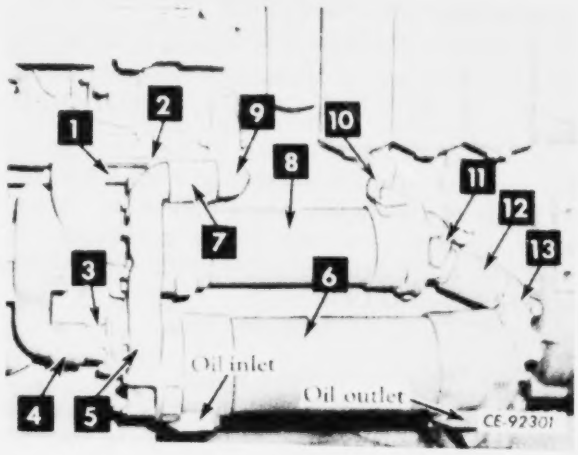



**Fig. 32. Removal of Coolers (330 Shown; Others Similar)**

1. Oil Pump Outlet Pipe
2. Water Pump Air Bleed Pipe
3. Header Water Inlet Connector
4. Hose
5. Water Header (front)
6. Torque Converter Oil Cooler
7. Hose
8. Engine Oil Cooler
9. Engine Water Inlet Elbow
10. Oil Cooler Outlet Elbow
11. Engine Oil Cooler Header (rear)
12. Hose
13. Torque Converter Oil Cooler Header (rear)

2. Loosen the clamps on the water pump outlet hose (4) and slide the hose onto the header (3).

3. Disconnect the nut on the water pump air bleed pipe (2) at the water inlet elbow (9).

4. Disconnect the coupling nut of the oil pump outlet pipe (1) at the front of the engine oil cooler.

5. Remove the three cap screws securing the water inlet elbow (9) to the crankcase.

6. Remove the three cap screws securing the oil cooler outlet elbow (10) to the cooler (8).

7. Disconnect the converter oil inlet lines from the converter cooler (6).

8. Remove the cap screws securing the front (5) and rear headers (11 and 13) to the crankcase and lift off the headers with coolers.

9. Remove the cooler headers from the coolers.

# LUBRICATING OIL AND WATER PUMP, OIL FILTER AND OIL COOLERS

## 13. INSPECTION AND REPAIR

1. Immerse the coolers into solvent such as Stoddard or equivalent to loosen any sludge or foreign matter. DO NOT USE CAUSTIC SOLUTION OF ANY KIND.

2. Drain and blow out any solvent and foreign matter inside of the coolers, being certain that all passages are clean and clear before installation. DO NOT USE WIRE BRUSHES OR STEEL SCRAPERS FOR REMOVING DEPOSITS.

### Leakage Test

To perform the following tests, it will be necessary to construct a cover plate for connecting a hydraulic or air coupling (refer to Fig. 33). When testing a torque converter oil cooler it will also be necessary to construct plate "B" shown in Fig. 34. Make plate "B" from plate "A" except disregard making hole for coupling connection. On engine oil coolers a one inch pipe plug is used in place of plate "B".

**CAUTION! Use adequate safety precautions when performing the following "Air Pressure" and "Hydraulic" tests.**

AIR PRESSURE TEST: Fasten gaskets or "O" rings and cover plates (as shown in Fig. 34) to cooler and immerse assembly in a container of water, preferably to a temperature of 49°C (120°F). This stabilizes the metal parts of the cooler. Apply 550 kPa (80 psi) of air while immersed in water. This pressure is sufficient to detect any leaks.

HYDRAULIC TEST: Fasten gaskets or "O" rings and cover plates (as shown in Fig. 34) to cooler and fill cooler with diesel fuel. Use a hydraulic hand pump and apply 795 kPa (115 psi) (engine oil cooler) and up to 1725 kPa (250 psi) (torque converter coolers.) This is a good test but not as easy to detect a minor leak as the air pressure test.

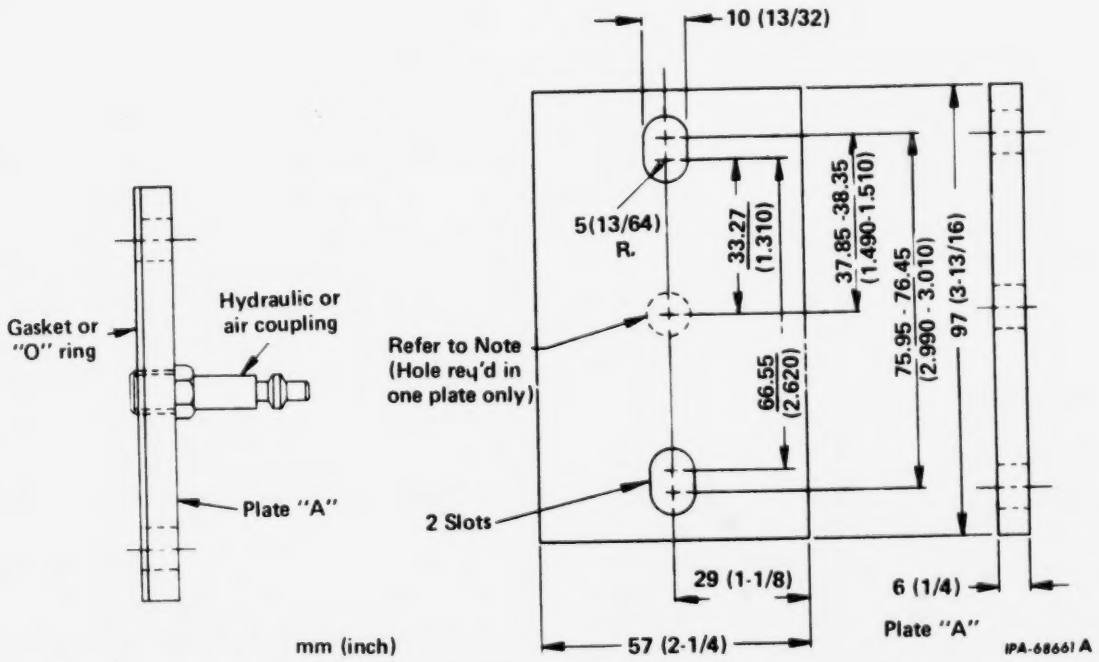
## 14. INSTALLATION (Refer to Fig. 32)

1. Using new gaskets, install the cooler headers to the coolers.

2. Install the headers with coolers to the crankcase.

3. Connect the converter oil inlet and outlet lines to the converter cooler.

4. Using a new gasket, secure the elbow (10) to the engine oil cooler (8).




NOTE: Drill and tap to your specifications for hydraulic or air coupling and install in plate as shown at left.

**Fig. 33. Cover Plate and Coupling for Testing Oil Coolers**

5. Using a new gasket, secure the elbow (9) to the crankcase.

6. Connect the coupling nut of the oil pump outlet pipe (1) to the front of the engine oil cooler.

7. Connect the nut of the water pump air bleed tube (2) to the water inlet elbow.

8. Slide the water pump outlet hose (4) forward, over the water pump opening and secure the hose clamps.

9. Fill the cooling system and the lubricating oil system as specified in the Operator's Manual, and check all connections for leaks.

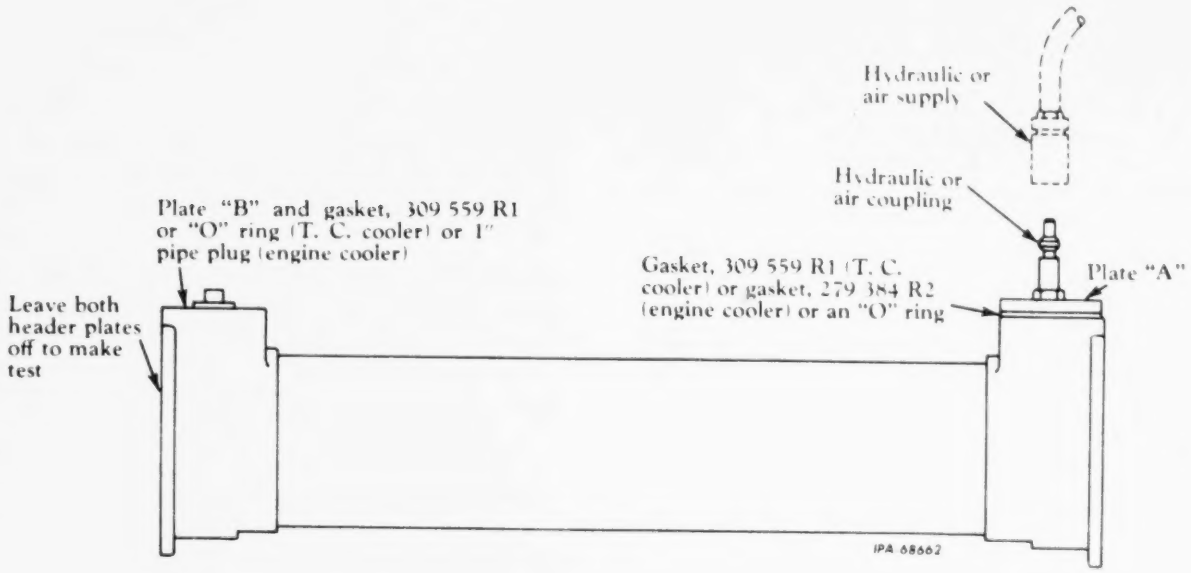

Hydraulic or air supply
Hydraulic or air coupling
Plate "B" and gasket, 309 559 R1 or "O" ring (T. C. cooler) or 1" pipe plug (engine cooler)
Gasket, 309 559 R1 (T. C. cooler) or gasket, 279 384 R2 (engine cooler) or an "O" ring
Plate "A"
Leave both header plates off to make test
IPA 68662

**Fig. 34. Cover Plates and Coupling Installed**

# TURBOCHARGER

## 1. DESCRIPTION

The turbocharger is essentially an exhaust driven blower. Its purpose is to increase diesel engine power output by supplying compressed inlet air to the engine.

## 2. GENERAL HANDLING AND MAINTENANCE

### General Handling

1. Cover or plug all openings in the turbocharger when handling or assembling to prevent entrance of foreign material. Covers must remain in place until the turbocharger is installed and all connections are secured.

2. All connections to the turbocharger (manifolds and piping) must be clean and free of foreign material, since serious damage to the turbocharger or engine could result. All connections must be air-tight.

3. Exhaust stacks of extra long length and other fixtures must not be rigidly attached to the turbocharger. If extended stacks are used, they must be supported by the hood. Exhaust stack must be higher than the intake stack.

### Maintenance

4. For initial running when installing a new or rebuilt turbocharger, it is recommended that four or five ounces of oil (same type and grade as used in the crankcase) be put into the oil inlet opening in the turbocharger with a squirt can. This will provide sufficient lubrication for the turbocharger bearings until normal engine lubrication is established. Connect the oil inlet line.

5. If the engine oil becomes contaminated by water, the turbocharger must be drained to prevent sludge formation.

6. It is imperative that the air cleaner service, outlined in the Operator's Manual, be rigidly followed because of the oil carry over and power losses that can be incurred with a restricted air cleaner.

**NOTE:** *Air flow requirements for diesel turbocharged engines are considerably greater than for a non-turbocharged engine of the same size, running at the same speed. Air inlet accessories such as pre-cleaners must be selected to minimize the restriction at the higher air flow and to maintain performance of the turbocharger unit.*

7. The engine crankcase breather must be cleaned periodically to assure that there is no restriction.

8. During normal operation, the turbocharger should be free from vibration or unusual noises.

9. The exhaust stack must be covered to prevent water from entering and damaging the turbine during shut-down periods or when the unit is being transported.

10. Periodically, check the cap screws, hold-down nuts, air connection and oil connections to and from the turbocharger for tightness. Retorque these parts after initial warmup. Hoses and oil lines must be inspected and replaced when necessary.

11. When starting turbocharged diesel engines, do not fully advance the engine speed control lever immediately. Run the engine at part throttle for a few minutes to allow thorough distribution of the lubricating oil. The machine must not be placed under load until normal oil pressure is reached.

12. It is important that the engine be operated at 1/2 throttle (no load) for three to five minutes before final shut-down after operating under load. This will aid in the cooling of both the engine and turbocharger, thus minimizing the possibility of damage.

13. It is advisable to allow the exhaust manifolds to cool before removing turbocharger from the engine. This will prevent warping.

## 3. REMOVAL (Refer to Fig. 1)

**NOTE:** *Before removing the turbocharger from the engine, clean the exterior surfaces of the turbocharger and connections.*

1. Disconnect the oil inlet and outlet tubes (5 and 6) from the turbocharger.

2. Loosen the hose clamps (3) on the hose (4).

3. DTI ENGINES ONLY: Remove cap screw and spacer on strap (strap is mounted to intercooler) that connects to support (7).

4. DTI ENGINES ONLY: Remove the hardware securing the exhaust outlet elbow (1) to the exhaust manifold. Remove support (7) from exhaust outlet elbow. Lift the elbow slightly to clear the manifold and pull it away from the turbocharger (see NOTE).

DT ENGINES ONLY: Remove the hardware securing the exhaust outlet elbow (1) to the exhaust manifold. Lift the elbow slightly to clear the manifold and pull it away from the turbocharger (see NOTE).

**NOTE:** *The exhaust sleeve (2) is loosely held between the exhaust elbow (1) and the turbine*

# TURBOCHARGER

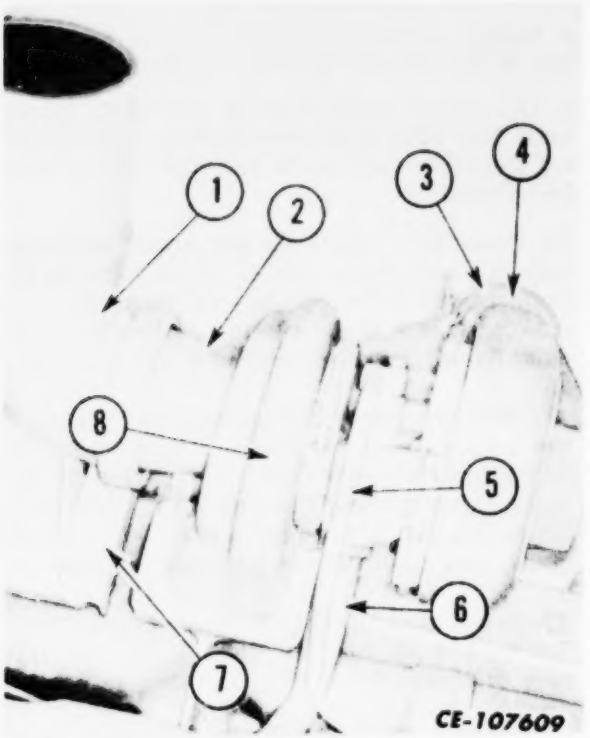



**Fig. 1. Turbocharger Removal (TD-25 SERIES C Equipped with Intercooler Shown — Others Similar)**

1. Exhaust Outlet Elbow
2. Exhaust Sleeve
3. Clamp
4. Air Discharge Hose
5. Oil Inlet Tube
6. Oil Outlet Tube
7. Support (DTI ENGINES)
8. Turbocharger

*housing. The sleeve must be held as the elbow is removed, to prevent the sleeve from dropping.*

5. Remove the four nuts securing the turbocharger assembly to the exhaust manifold.

6. Lift off the turbocharger (8) with gasket.

7. For information on servicing the turbocharger refer to "Turbocharger Service Manual," ISS-1047.

**4. INSTALLATION (Refer to Fig. 1)**

1. Inspect the air intake system for loose bolts, nuts or any foreign material.

2. Inspect the exhaust manifold for fins or projections which may become loose and for pieces of gasket or other foreign material. If any foreign material is evident, remove the manifold and clean it.

3. Inspect the oil drain tube (6) to be sure the inside diameter has not been reduced by swelling or that the line is not clogged. Inspect the oil supply tube (5) for dirt, clogging or deterioration.

4. Inspect the turbocharger mounting pad on the manifold for flatness. Be sure that all of the old gasket has been removed.

5. Check the oil change period. If the next change period is near, it is recommended that the oil and oil filter element is changed before operating the turbocharger.

6. Install the turbocharger (8) onto the exhaust manifold using a new gasket.

7. Apply "NEVER-SEEZE" or a similar compound to the manifold studs and install the four nuts that secure the turbocharger to the manifold. Torque nuts to 47 N·m (35 ft-lbs).

8. Replace the seal in the end grooves of the exhaust sleeve, if necessary. Insert the exhaust sleeve (2) into the sleeve retainer on turbocharger.

9. DTI ENGINES ONLY: Install the exhaust outlet elbow (1) with support (7) onto the exhaust manifold and onto the exhaust sleeve (2). Install and secure the hardware. It is recommended that the "NEVER-SEEZE" or a similar compound be applied to the cap screw threads.

DT ENGINES ONLY: Install the exhaust outlet elbow (1) onto the exhaust manifold and onto the exhaust sleeve (2). Install and secure the hardware. It is recommended that the "NEVER-SEEZE" or a similar compound be applied to the cap screw threads.

10. DTI ENGINES ONLY: Install and secure cap screw and spacer to support (7) and strap (strap is mounted to intercooler).

11. Connect the oil outlet tube (6) to the turbocharger.

12. Using a squirt can, put four or five ounces of oil into the oil inlet opening in the top of the turbocharger.

13. Connect the oil inlet tube (5) to the turbocharger.

14. Connect the hose (4) and secure with clamps (3).

15. Operate the engine observing the turbocharger for any of the following:

a. Unusual turbocharger noises.

b. Lubrication leaks.

c. Fastening to the engine not secure.

d. Excessive vibration.

e. Excessive exhaust smoke.

f. Air leaks in the air cleaner-to-turbocharger or turbocharger-to-intake manifold ducting.

Investigate and correct any of these conditions immediately to avoid possible turbocharger or engine failure.

16. Retighten the cap screws, hold-down nuts, air connections and oil connections to and from the turbocharger after the initial warm-up.

## INJECTION PUMP AND ADAPTER

### 1. DESCRIPTION

The injection pump adapter is located on the left side of the engine, connecting the injection pump drive gear and the injection pump. The injection pump is driven by the drive gear which engages the camshaft gear in the crankcase front cover. The fuel supply pump is mounted on the side of the injection pump driven by the pump camshaft and is equipped with a hand primer.

### 2. REMOVAL

1. Clean the injection pump, adapter housing and all connections with clean diesel fuel.

2. TD-25 SERIES C: Close the fuel shut-off valve at the fuel tank.

**NOTE:** *TD-25 SERIES C: The air cleaner dust unloader is located right above the injection pump. Be sure to clean this out before disconnecting any lines to prevent dirt from unloading into pump openings.*

3. Disconnect all fuel lines and lube line from the pump. Cap or tape all openings of the pump and lines immediately after disconnecting to prevent the entry of dirt. Secure the fuel reservoir or filter-to-injection pump hose in an upright position to prevent draining of fuel.

4. PUMPS EQUIPPED W/ANEROID: Disconnect the boost pressure line at the aneroid.

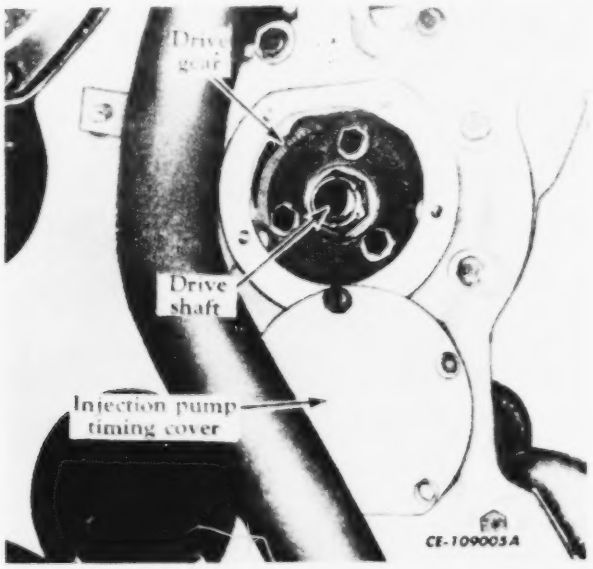



**Fig. 1. Injection Pump Timing Port in Crankcase Front Cover**

5. Disconnect the control linkage at the pump.

6. Rotate the engine crankshaft clockwise until the No. 1 cylinder is on the compression stroke and position engine vibration damper to degree mark specified (refer to "SPECIFICATIONS" in Section 1) with last movement made in the direction of engine rotation. This will take up all the slack in the gear train.

7. Remove the cap screws securing the injection pump timing cover to the crankcase front cover and position the cover as shown in Fig. 1.

8. Loosen the three timing pointer cap screws (see NOTE) securing the drive gear to the hub on pinion shaft.

**NOTE:** *If cap screws are secured with a lock plate (13, Fig. 3), the lock plate and retainer plate (14) should not be reused. Replace with three washers (3). Refer to parts catalog for ordering.*

**NOTE:** *There are helical gears on the pump and the pinion shaft, and in order for the pump to be removed or installed, one or both of these gears have to rotate. The cap screws are loosened to permit the shaft to rotate within the limits of the elongated holes in the drive gear.*

9. Remove the two bolts securing the pump to the pump bracket.

10. Remove the four cap screws securing the injection pump adapter to the adapter housing.

11. Pull the pump to the rear until the drive gear clears the adapter housing, then lift the pump from the engine.

12. (Refer to Fig. 2). Disconnect and remove the tube (1) from the tee (2). Disconnect the tube (3) from the tee (2). Remove the cap screws securing the clips (4) to the crankcase and position the tube (3) away from the adapter housing.

13. Rotate the engine clockwise until the "TC" mark on the vibration damper is in line with the timing pointer. At this point the number one piston is on top-dead-center of the compression stroke.

14. Remove the front three cap screws from the push rod chamber cover to provide clearance for removal of adapter housing.

15. Remove the cap screws, nuts and washers securing the adapter housing to the crankcase front cover. Remove the adapter and housing.

# INJECTION PUMP, ADAPTER AND INJECTION NOZZLES

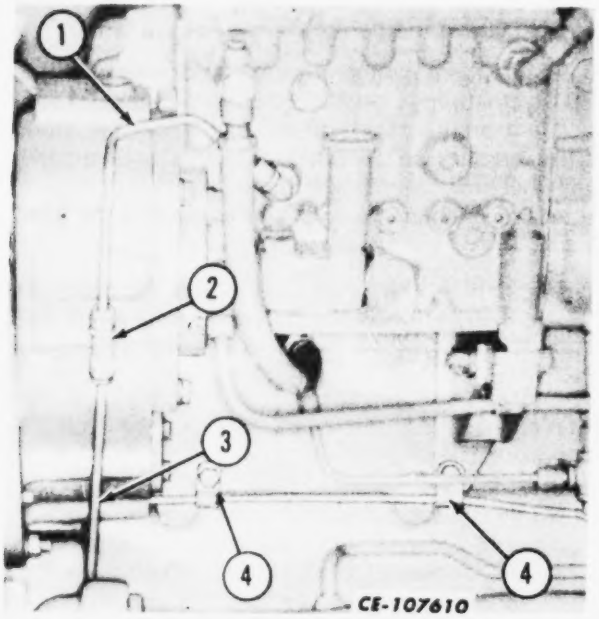



Fig. 2. Injection Pump Adapter Disconnect Points (TD-25 SERiES C Shown — Other Similar)

Fig. 4. Removing Drive Gear

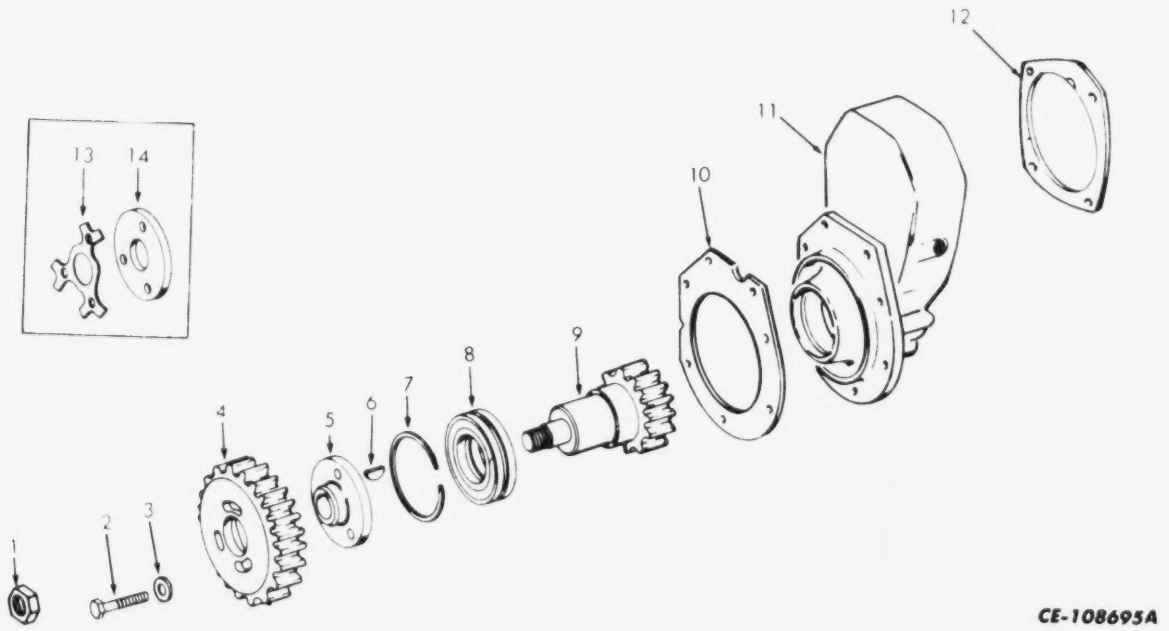



Fig. 3. Exploded View of Injection Pump Adapter

1. Nut
2. Screw
3. Washer.
4. Drive Gear
5. Drive Gear Hub.
6. Key.
7. Bearing Retainer Snap Ring.
8. Pinion Drive Shaft Bearing.
9. Pinion Drive Shaft.
10. Gasket.
11. Injection Pump Adapter Housing.
12. Gasket.
13. Drive Gear Lock Plate (*).
14. Drive Gear Retainer Plate (*).

(*) - Replace with three washers (Ref. 3).

### 3. DISASSEMBLY (Refer to Fig. 3)

1. Secure the adapter housing in a vise as shown in Fig. 4.

2. Remove the three cap screws securing the gear (4) to the hub (5) and remove the washer (3) or plates (13 and 14) and gear (4).

3. Using injection pump hub holding tool, 1 020 327 R1, remove the nut (1) from the pinion shaft (9) as follows (Fig. 5):

   a. Secure the holding tool to the hub (5) with two 3/8 NF x 1-1/8 inch cap screws.

   b. Install a suitable drift into hole in the adapter housing to anchor the holding tool.

   c. Remove the nut from the pinion shaft.

   d. Remove the drift and holding tool.

4. Using a puller, remove the hub (5) from the pinion shaft (9) (Fig. 6). Remove the key (6) from the shaft.

5. Remove the snap ring (7).

6. Remove the adapter housing from the vise and position it on a press as shown in Fig. 7.

7. Press the pinion shaft with bearing out of the housing (Fig. 7).

8. Support the bearing cone, as shown in Fig. 8, and press the shaft (9) out of the bearing (8). Be sure that the gear on the shaft will clear the support as the shaft is pressed out.

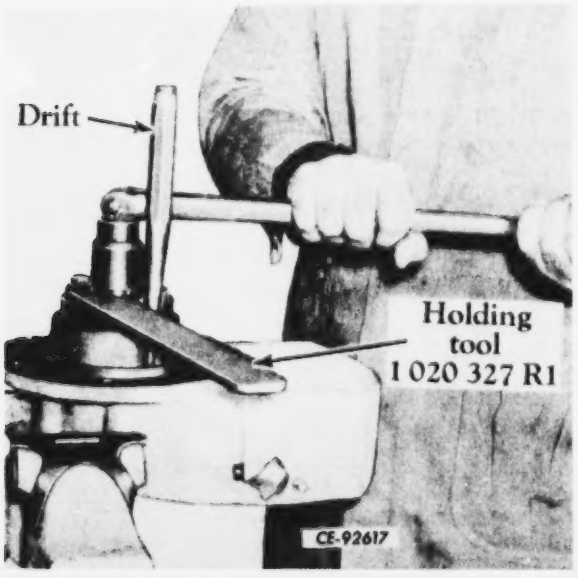



Fig. 5. Removing Pinion Shaft Nut

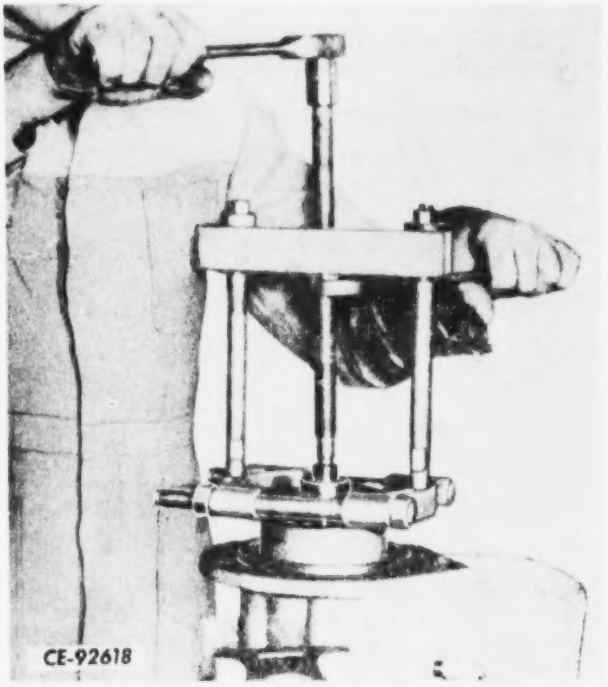



Fig. 6. Removing Hub from Pinion Shaft

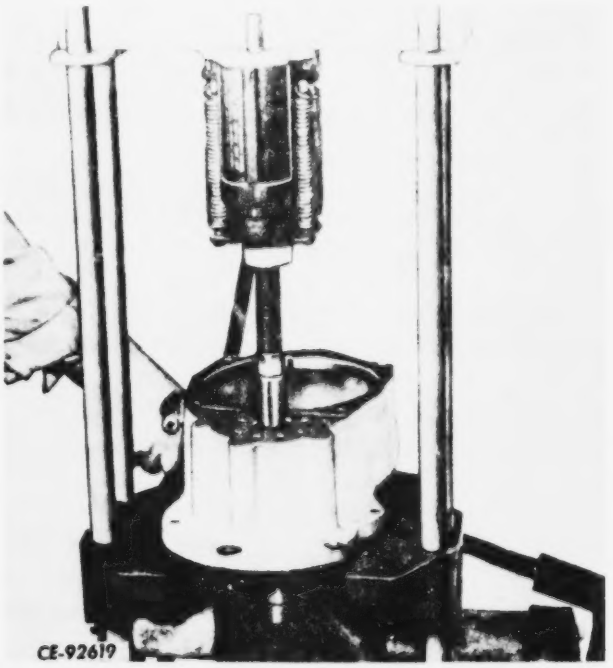



Fig. 7. Pressing Pinion Shaft and Bearing Out of Adapter Housing

# INJECTION PUMP, ADAPTER AND INJECTION NOZZLES

## 4. INSPECTION AND REPAIR (Refer to Fig. 3)

1. Clean all parts with solvent. Inspect the bearings (8) for corrosion or wear, and replace if necessary.

2. Inspect the pinion shaft and gear for wear or damage.

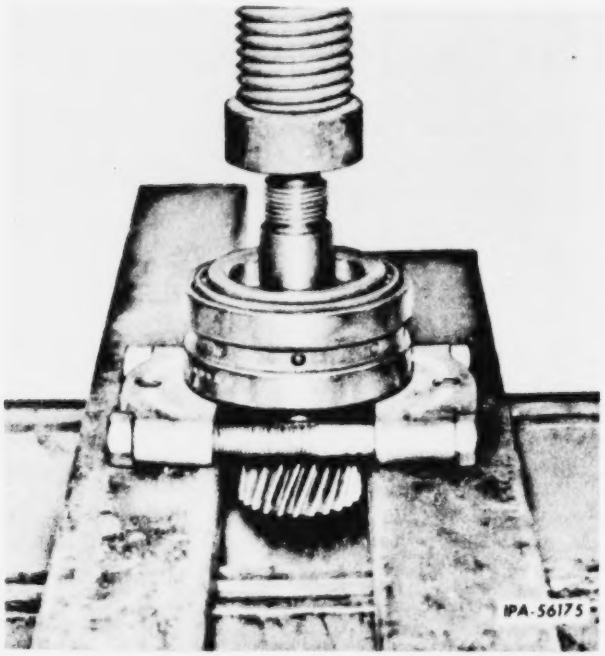



**Fig. 8. Pressing Drive Shaft Out of Bearing**

### Procedure for Servicing and Adjusting Tapered Roller Bearing (Refer to Fig. 9)

Since the bearings, spacer and cup assembly are furnished as a matched unit, a definite procedure for adjustment of the tapered roller bearings, due to normal wear, must be followed.

1. Assemble the complete bearing assembly on a flat surface (surface plate).

2. Place a minimum weight of 9 Kg (20 lbs) on top of the bearing assembly. (This will keep roller in alignment.)

3. Rotate cup "A" a minimum of four revolutions in each direction.

4. With spacer "B" in place, set the dial indicator at zero. Check at three different points.

5. Slide the dial indicator off cone "C" carefully. (Do not upset the indicator setting.)

6. Remove the weight, cone "C" and spacer "B." Then replace cone "C" and weight. (Do not replace spacer "B.")

7. Repeat rotation of cup "A" and slide the dial indicator onto cone "C." Be careful to get an accurate reading from the dial indicator. Check at three different points.

8. Factory set end play in a new bearing assembly is 0.114-0.152mm (0.0045-0.0060 in).

If the reading on the dial indicator shows a greater drop than the maximum permissible end play of

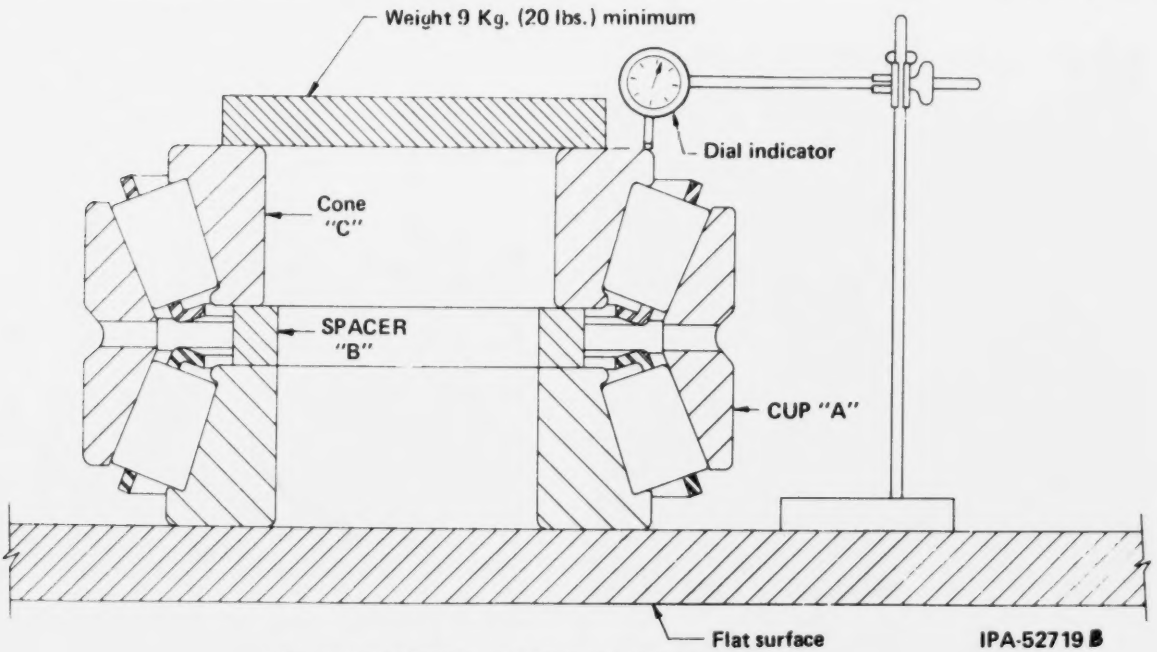



**Fig. 9. Adjustment of Tapered Roller Bearings**

0.23mm (0.009 in.), grinding or lapping of the spacer is necessary. The amount to be ground off the spacer is the difference between the indicator reading and the factory set end play.

A bearing assembly that is heavily pitted or scored must not be salvaged.

**5. REASSEMBLY (Refer to Fig. 3)**

1. Support the bearing assembly (8) between two flat plates on a hydraulic press. Press the shaft (9) into the bearing, until the shoulder on the shaft bottoms on the bearing cone.

2. Support the adapter housing on a hydraulic press. Press shaft (9) into the housing.

3. Install the snap ring (7).

4. Install the hub key (6) and press the hub (5) onto the shaft (9) until it bottoms on the bearing (8) (Fig. 10).

5. Using injection pump hub holding tool, 1 020 327 R1, install the nut (1) onto the pinion shaft (9) as follows (Fig. 11):

a. Secure the holding tool to the hub (5) with two 3/8 NF x 1-1/8 inch cap screws.

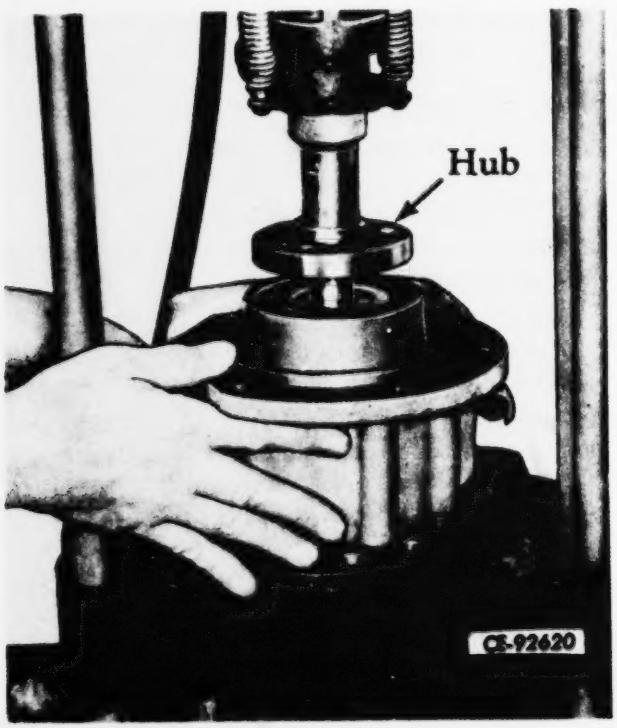



**Fig. 10. Pressing Hub onto Pinion Shaft**

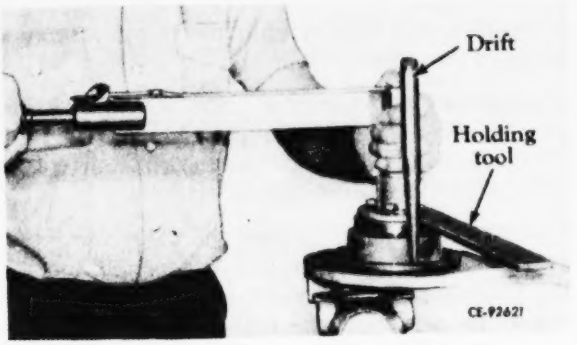



**Fig. 11. Torquing Pinion Shaft Nut**

b. Install a suitable drift into the hole in the adapter housing to anchor the holding tool.

c. Install and tighten the nut to 217 N·m (160 ft-lbs) torque.

d. Remove the drift and holding tool.

6. Install the gear (4) on the hub (5) (refer to Fig. 4).

7. Install the washer (3) and screw (2) finger tight.

**6. INSTALLATION**

**Installing the Injection Pump Adapter**

1. Crank the engine until the "TC" mark on the vibration damper is in line with the timing pointer on the crankcase front cover. Make sure the number one piston is on top-dead-center of the compression stroke.

2. Rotate the pinion shaft (9, Fig. 3) until the punch mark on the drive gear (4) is at the six o'clock position.

3. Install the assembled adapter housing on the crankcase front cover, aligning the punch mark on the camshaft gear with the punch mark on the drive gear. Secure the adapter housing to the crankcase front cover.

4. Install and secure the front three cap screws in the push rod chamber cover.

5. (Refer to Fig. 2): Connect the tube (3) to the tee (2). Secure the clips (4) to the crankcase with the cap screws previously removed. Connect the tube (1) to the tee (2).

**Installing and Timing Injection Pump to Engine**

6. Install a new gasket onto the pump mounting flange of the adapter housing.

7. Rotate engine crankshaft clockwise (as viewed from fan drive end) to static timing degrees with the No. 1 cylinder on compression stroke. (Refer to "SPECIFICATIONS" in Section 1).

8. (Refer to Fig. 1): Loosen the three cap screws on the drive gear and rotate the pinion shaft so that the cap screws are approximately half way between the center of the elongated holes and the clockwise end of the drive gear.

9. Position the injection pump camshaft so that the pointer aligns with the timing mark on the gear (see NOTE).

**NOTE:** *The pump shaft will not stay in location but will rotate counterclockwise (as viewed from drive end of pump) approximately 12 degrees to stable stationary position. Allow the pump shaft to remain in this position.*

10. Install the pump on the engine. Tighten pump adapter mounting screws.

11. (Refer to Fig. 12): With the cap screws (3) loosely installed, remove pivot bracket cap screw (1). Adjust support (4) and bracket (2) so that with these parts tightened, the pivot cap screw can be inserted freely through the bracket and support. Install pivot cap screw.

**NOTE:** *Remove the plug located on the top of the injection pump adapter housing so that the injection pump gear is visible for timing procedure.*

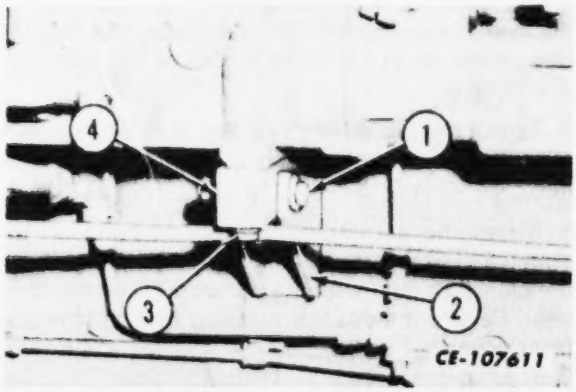



**Fig. 12. Injection Pump Adjustable Support with Bracket**

1. Screw
2. Bracket
3. Screw
4. Support

12. Rotate the drive gear (4, Fig. 3) to bring the mark on the injection pump gear into alignment with the pointer on the pump and tighten the three drive gear cap screws evenly.

13. Rotate the engine crankshaft counterclockwise (as viewed from fan drive end) to about 60 degrees before top dead center of number one cylinder and bring it back clockwise to specified timing (refer to "SPECIFICATIONS" in Section 1 for static timing).

14. Check timing pointer to be sure it lines up with the mark on the gear. If pointer is not aligned loosen cap screws on drive gear and align. Retighten cap screws.

15. Install plug on pump adapter housing.

16. Bend the tabs on the lock plate (2, Fig. 3) over the cap screws.

17. Secure the injection pump timing cover (Fig. 1) to the crankcase front cover.

18. Connect all lines and controls to the pump. Lubricate injection line nuts with diesel fuel or flushing fuel but do not tighten the six injection lines at this time.

19. Check to be sure the control linkage is properly adjusted. (Refer to Machine Chassis Manual for linkage adjustment information.)

20. With the control lever positioned in the half-throttle position, crank the engine (at 10 second intervals) until fuel flows from the loose fuel line nuts (see NOTE). Tighten the line nuts at the pump to 40 N·m (30 ft-lbs) torque.

**NOTE:** *Fuel system may need priming. If fuel does not flow from lines, refer to "HAND PRIMING FUEL SYSTEM" in Section 2.*

21. Start the engine and check to be sure that all connections made do not leak.

**NOTE:** *Be sure engine is at operating temperature before making high idle speed as follows:*

22. HIGH IDLE SPEED ADJUSTMENT: Check and adjust engine high idle speed as follows:

**NOTE:** *DO NOT OVERSPEED ENGINE.*

**NOTE:** *(PUMPS EQUIPPED WITH ANEROID): Be sure the boost pressure line is connected to the aneroid before adjusting high idle speed.*

a. Check engine high idle speed (see NOTE) with the pump control lever against the high idle stop screw.

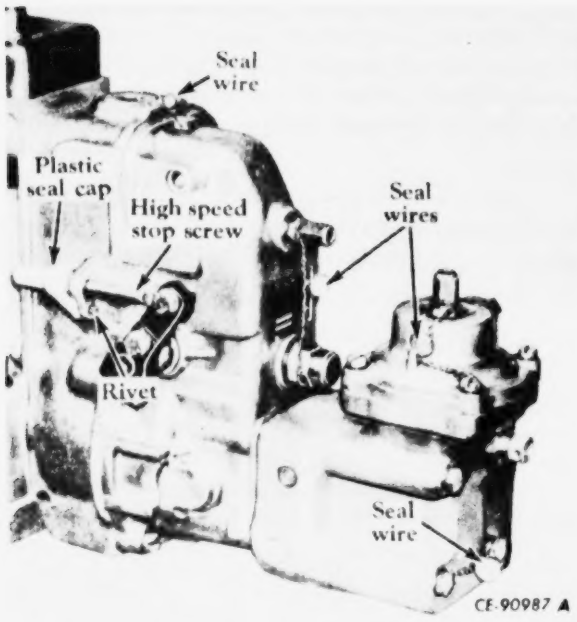



**Fig. 13. Seal Wire Location (Pumps Equipped w/Rear Mounted Aneroid).**

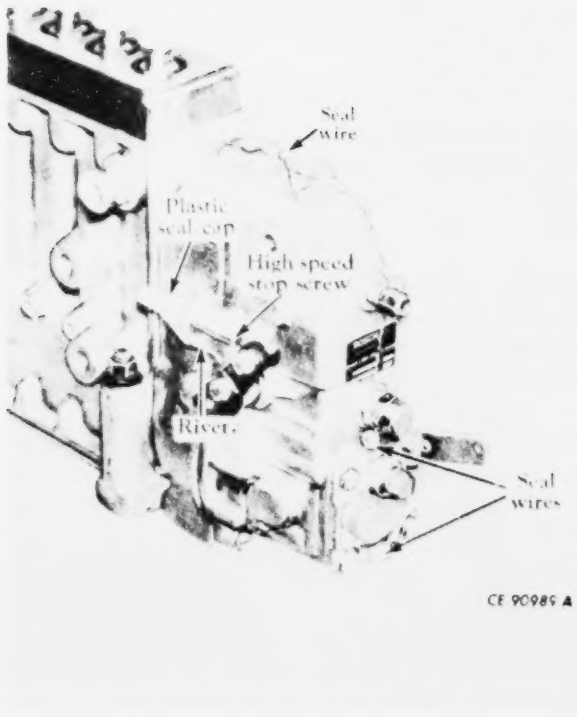



**Fig. 14. Seal Wire Locations (Pumps Not Equipped with Aneroid)**

**NOTE:** *Engine high idle speed should be within ±20 rpm of the maximum idle rpm stamped on the vehicle serial number plate.*

b. If out of specified speed, remove the seal rivet from the boss and plastic seal cap (Fig. 13 or 14) with a small punch. Be careful not to damage the seal rivet boss when removing the rivet.

c. Loosen the high idle speed stop screw lock nut and adjust to specified high idle. Tighten the lock nut.

**NOTE:** *Check to be sure that the external pump control linkage travels 3-9mm (1/8-3/8 in.) beyond the pump control lever with the pin connecting the linkage to the pump lever removed, and the accelerator pedal or governor control lever is on its high idle stop screw.*

23. BUMPER SPRING ADJUSTMENT: The bumper spring adjustment screw for idle surge control is preset to protrude 11.4mm (0.45 in.) from lock nut to slotted end of adjustment screw. This adjustment to be changed only if it is necessary to eliminate surging. If necessary, adjust as follows:

a. Remove the bumper screw cap.

b. Loosen the bumper spring adjustment screw lock nut and turn the screw in to just contact at the speed at which the surge occurs.

c. Tighten the lock nut and recheck high idle speed. If high idle has increased to more than 20 rpm above the maximum idle speed stamped on the vehicle serial number plate, back-out the bumper spring adjustment and reset high idle to the low side of the specified rpm range.

d. Readjust the bumper spring to eliminate surge.

**NOTE:** *Engine rpm must not exceed that specified, as it will definitely affect rated load operations.*

**NOTE:** *CRAWLER TRACTORS ONLY: The following "Low Idle Speed Adjustment" procedure is not necessary on these applications. Low idle speed is automatically adjusted when the external pump control linkage is adjusted correctly.*

24. LOW IDLE SPEED ADJUSTMENT (RUBBER TIRE EQUIPMENT ONLY): Check and adjust low idle speed as follows:

a. Check engine low idle speed (650 ± 25 rpm).

b. If out of specified speed, remove the cap nut from the low idle adjustment screw (located above the bumper spring adjustment screw).

Loosen the low idle adjustment screw lock nut and adjust to the specified low idle. Tighten lock nut and install cap nut.

**NOTE:** *Check to be sure that the external pump control linkage travels 3-9mm (1/8-3/8 in.) beyond the pump control lever with the pin connecting the linkage to the pump lever removed, and the accelerator pedal is on its low idle stop.*

25. Install the new seal cap over the high idle adjustment screw and secure to the boss with new rivet. Use the seal pliers (Tool No. PLT-371-4) and seal the rivet (Fig. 13 or 14).

26. Install new seal wires and seal all adjustment points as shown in Fig. 13 or 14.

### 7. HYDRAULIC METHOD OF CHECKING PORT CLOSURE (Pump Timing Point)

The following procedure is to be used to check pump-to-engine timing.

1. Move the governor control lever against the high speed stop screw and secure in this position (Fig. 15).

2. Move the shut-off lever approximately 19-25mm (3/4-1 in.) (measured at outer pin hole in lever) from "Stop" toward "Run" position and secure in this position (Fig. 15) (see NOTE).

**NOTE:** *If the shut-off lever is in the full "Run" position, the starting spring will move the injection pump control rack to its starting position where the pump timing is automatically retarded to 10 to 12 degrees due to retard notch being lined up with control port on plunger.*

3. Disconnect the fuel line from supply pump at inlet on injection pump. Connect a test pump capable of providing 1725-2070 kPa (250-300 psi) (7 gal/hr. minimum capacity).

4. Remove the return valve and plug the opening.

5. Disconnect the No. 1 fuel injection tube at the injection pump delivery valve and install a drip tube. Make drip tube out of 1/4 inch O.D. injection tubing bent in a "U" shape with free end cut at 45 degrees to centerline of tube.

6. Crank the engine in direction of rotation until the number one piston is approaching T.D.C. on compression stroke (see NOTE).

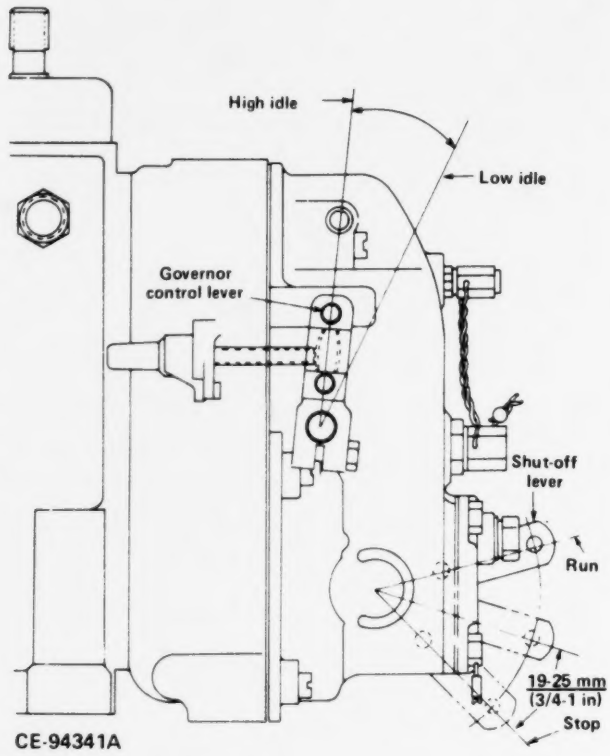



**Fig. 15. Injection Pump Governor Control Lever and Shut-Off Lever Positions**

**NOTE:** *The large inspection plug on side of injection pump adjacent to the number one plunger may be removed to observe number one tappet on up stroke.*

7. Continue cranking the engine until a degree mark (approximately 10 to 20 degrees before the specified timing degree mark) lines up with the timing pointer. (Refer to "SPECIFICATIONS" in Section 1.

8. Hand crank the engine slowly while maintaining 1725-2070 kPa (250-300 psi) pressure with the test pump. Note the flow of fuel cut of drip tube from the No. 1 delivery valve.

9. Continue cranking and maintaining pressure until the fuel flow diminishes from flow to drops, then stop cranking the engine.

10. Check at what point the degree mark on the vibration damper lines up with the timing pointer. This point should coincide with the specified timing within plus or minus one engine degree. If timing is incorrect it must be retimed as outlined in the following step 11. (See NOTE.)

**NOTE:** *To verify that pump-to-engine timing is correct or incorrect, repeat steps 6 through 10 two or three times to verify results.*

11. Re-time pump-to-engine as follows:

a. Rotate the engine crankshaft clockwise (as viewed from front) until the No. 1 cylinder is coming up on the compression stroke and position the engine vibration damper to the degree mark specified in "SPECIFICATION" in Section 1 with the last movement made in direction of engine rotation. This will take-up all the slack in the gear train.

b. Loosen the three drive gear retainer plate cap screws (Fig. 16).

c. Remove the plug from the top of the pump adapter housing.

d. Rotate drive shaft to align timing pointer and timing mark on pump gear. Tighten the three drive gear retainer bolts, replace cover and plug.

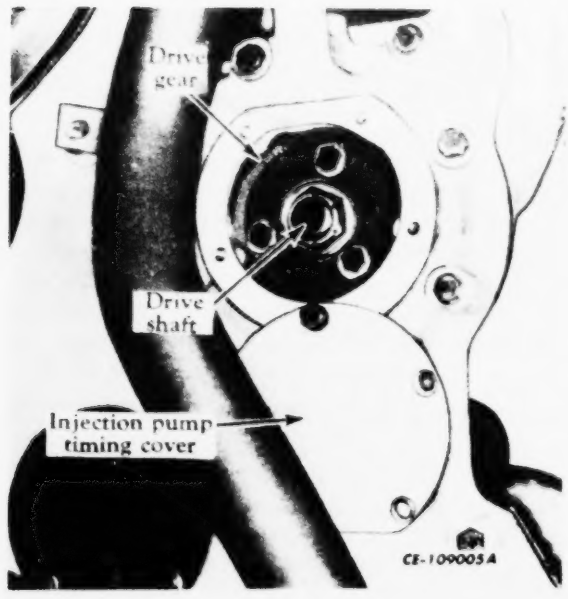



**Fig. 16. Injection Pump Timing Port in Crankcase Front Cover**

e. If the drive shaft cannot be rotated to align pointer and mark within the confines of the three drive gear retainer plate cap screw slots, the injection pump must be removed. (Refer to Par. 2, "REMOVAL," in this section.)

f. Reinstall the pump as described in steps 7 through 14 under Par. 6 in this section.

g. Repeat the hydraulic method of checking port closure as previously outlined.

12. Remove the drip tube and connect the No. 1 fuel injection tube to the delivery valve.

13. Disconnect the wires securing the governor control and shut-down levers.

14. Disconnect the test pump and connect the fuel line at the pump inlet.

15. If it was necessary to retime the pump-to-engine as outlined in step 11, and timing was corrected; then complete steps 15 through 26 under Par. 6 in this section.

## INJECTION NOZZLES

### 8. INJECTION NOZZLE TESTING

1. Remove the injection nozzles from the cylinder heads. Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES" for removal procedure.

**NOTE:** *Before testing nozzles, it is advisable to place them in a cold decarbonizing solution for at least one hour.*

After removing nozzles from solution, wash off the exterior of all dirt and carbon.

Use clean filtered diesel fuel and standard type hand pump (equipped with a pressure gauge having a capacity of at least 4000 pounds) when testing the nozzle assemblies.

**CAUTION! Keep the hands away from the nozzle spray. At opening pressure, the velocity of the spray could puncture the skin. Consult a doctor at once if this should happen.**

2. Connect the nozzle loosely to the hand test pump. Pump the handle several strokes to flush out the fittings; then tighten.

3. CHATTER: Operate the test pump and observe if nozzle chatters at opening pressure and if all orifices in the nozzle tip are clear. Fuel should spray in an atomized mist and the valve should emit a sharp high-pitched chatter. If chattering does not occur, flush with test pump with rapid complete strokes.

4. OPENING PRESSURE: Pump the test pump handle a few strokes to clear the air from the nozzle and then raise the pressure steadily. Observe the gauge pressure at which the valve opens. Refer to Par. 2, "SPECIFICATONS" in Section 1 for specified opening pressure. If the pressure is below that specified, the nozzle must be disassembled and reset by addition of shims. Refer to "Robert Bosch Fuel Injection Pump Service Manual," ISS-1522.

5. SEAT LEAKAGE: Wipe the nozzle tip dry. Bring the pressure up slowly to 3450 kPa (500 psi) below the nozzle opening pressure and maintain this pressure for 5 seconds. Wetting of the nozzle is permissible without the formation of a droplet.

**NOTE:** *Do not wipe the tip with the finger as this will tend to draw the fuel present in the sac hole through the orifices and falsely indicate a leak and rejection of a good valve. Touch a finger or hold a wiper lightly against the tip of the valve.*

Leakage at the seat may be caused by dirt or foreign material, carbon or gum deposits at the seat area or excessive wear of the seat. If the seat is worn, it may be refinished with precision grinding equipment. (Refer to "Robert Bosch Fuel Injection Pump Service Manual," ISS-1522.

6. STEM LEAKAGE: Bring the pressure on the nozzle to 10350 kPa (1500 psi). If there is any leakage from the return, collect it. To conserve time, nozzle may be in inverted position. The maximum allowable leakage is one cc in one minute at this pressure.

Excessive leakage at this point can be caused by scratches or poor sealing at the flat surfaces of the nozzle body, intermediate plate or valve body. If this possibility has been already eliminated, there is excessive clearance between the valve stem and body. This condition necessitates replacement of the nozzle valve.

7. Install the injection nozzles. Refer to Section 2, "MANIFOLDS, CYLINDER HEADS AND VALVES" for installation procedure.

## AIR COMPRESSOR (TU-FLO 500)

### 1. DESCRIPTION

**NOTE:** *Refer to the Chassis Service Manual for detailed information on the air governor.*

#### General

The TU-FLO 500 air compressor is used on the model H-100C Pay loader and 330 and 340 Pay haulers (See NOTE).

**NOTE:** *Refer to the Chassis Service Manual SM-330/340 for detailed information on the air compressor for model 330 and 340 Pay haulers.*

The air compressor is a single stage, reciprocating, two cylinder type with automatic inlet valves. The rated capacity of the compressor is 0.34 $m^3$/min (12 $ft^3$/min), which is based on the piston displacement in cubic feed per minute with the compressor running at a speed of 1250 rpm.

The compressor cylinder head and block are water cooled by the coolant from the engine cooling system.

The compressor is lubricated by the engine lubricating oil. The crankshaft has an oil passage in which the oil is forced through and out around each connecting rod journal. This oil is also used to lubricate the cylinder bores and crankshaft bearings. The wrist pins and bushings are lubricated by an oil dripping method from the piston through the rod. Surplus oil returns to the engine crankcase through the compressor crankcase.

#### Operation

The compressor runs continuously while the engine is running, but the actual compression of air is controlled by the governor. The governor, acting in conjunction with the unloading mechanism in the compressor cylinder block, starts or stops the compression of air by unloading or loading the compressor when the pressure in the air system reaches the desired minimum of 593-620 kPa (86-90 psi) or 710-765 kPa (103-111 psi) maximum.

COMPRESSING AIR (LOADED): During the down stroke of each piston, a partial vacuum is created above the piston which unseats the inlet valve, allowing air drawn through the intake port to enter the cylinder above the piston, (Fig. 1). As the piston starts the upward stroke, the air pressure on top of the inlet valve, plus the inlet valve return spring force, closes the inlet valve. The air above the piston is further compressed until the pressure lifts the discharge valve and the compressed air is discharged through the discharge line into the reservoir (Fig. 2). As each piston starts its down stroke, the discharge valve above it returns to its seat, preventing the compressed air from returning to the cylinder, as the intake and compression cycle is repeated.

NOT COMPRESSING AIR (UNLOADED): When the air pressure in the reservoir reaches the maximum setting of the governor, 710-765 KPa (103-111 psi), compressed air from the reservoir passes through the governor into the cavity below the unloading pistons in the compressor cylinder block. This air pressure lifts the unloading pistons which in turn lift the inlet valves off their seats (Fig. 3).

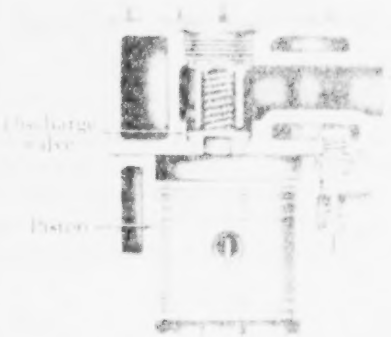


Fig. 1. Intake of Air

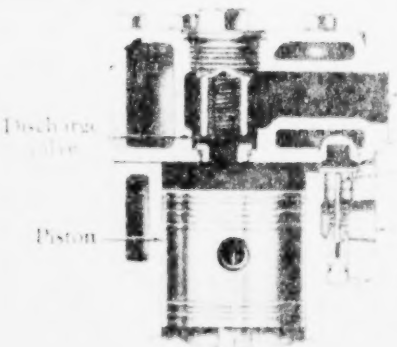


Fig. 2. Compression of Air

# AIR COMPRESSOR

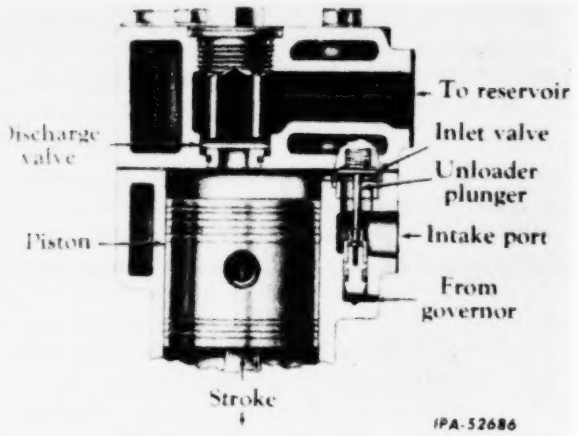



**Fig. 3. Compressor Unloading Mechanism**

PASSAGE OR AIR DURING NON-COMPRESSION: With the inlet valves held off their seats, the air during each upstroke of the piston is forced through the air inlet cavity and to the other cylinder where the piston is on the down stroke. When the air pressure in the reservoir is reduced to the minimum setting of the governor, 593-620 KPa (86-90 psi), the governor releases the air pressure beneath the unloading pistons. The unloading piston return spring then forces the piston down and the inlet valve springs return the inlet valves to their seats and compression is resumed.

**2. REMOVAL (Refer to Fig. 4)**

1. Loosen the hardware securing the mounting base (9) to plate (11) and adjust the compressor so that belt (12) can be removed from pulley (8). Retighten hardware until compressor is removed.

2. Disconnect water outlet hose (1) and inlet hose (4) at the air compressor and position them so they will not interfere as the compressor is being removed.

3. Disconnect the lube oil inlet hose (18) at the air compressor and position hose so it will not interfere as the compressor is being removed.

4. Remove the hardware securing air compressor to mounting base (9) and lift compressor from base.

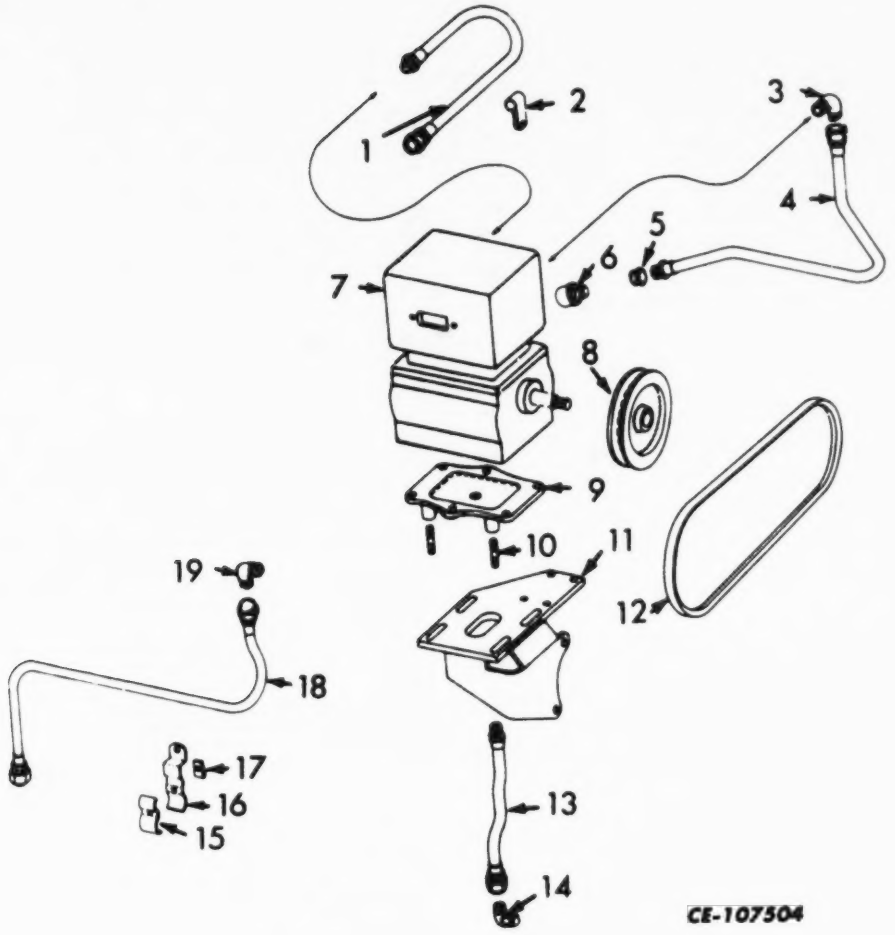



**Fig. 4. Air Compressor and Related Parts**

1. Water Outlet Hose
2. Hose Clip
3. Elbow
4. Water Inlet Hose
5. Bushing
6. Elbow
7. Air Compressor
8. Air Compressor Pulley
9. Base
10. Stud
11. Mounting Plate
12. Air Compressor Belt
13. Lube Oil Outlet Hose
14. Elbow
15. Clamp (short)
16. Clamp (long)
17. Nut
18. Lube Oil Inlet Hose
19. Elbow

# AIR COMPRESSOR

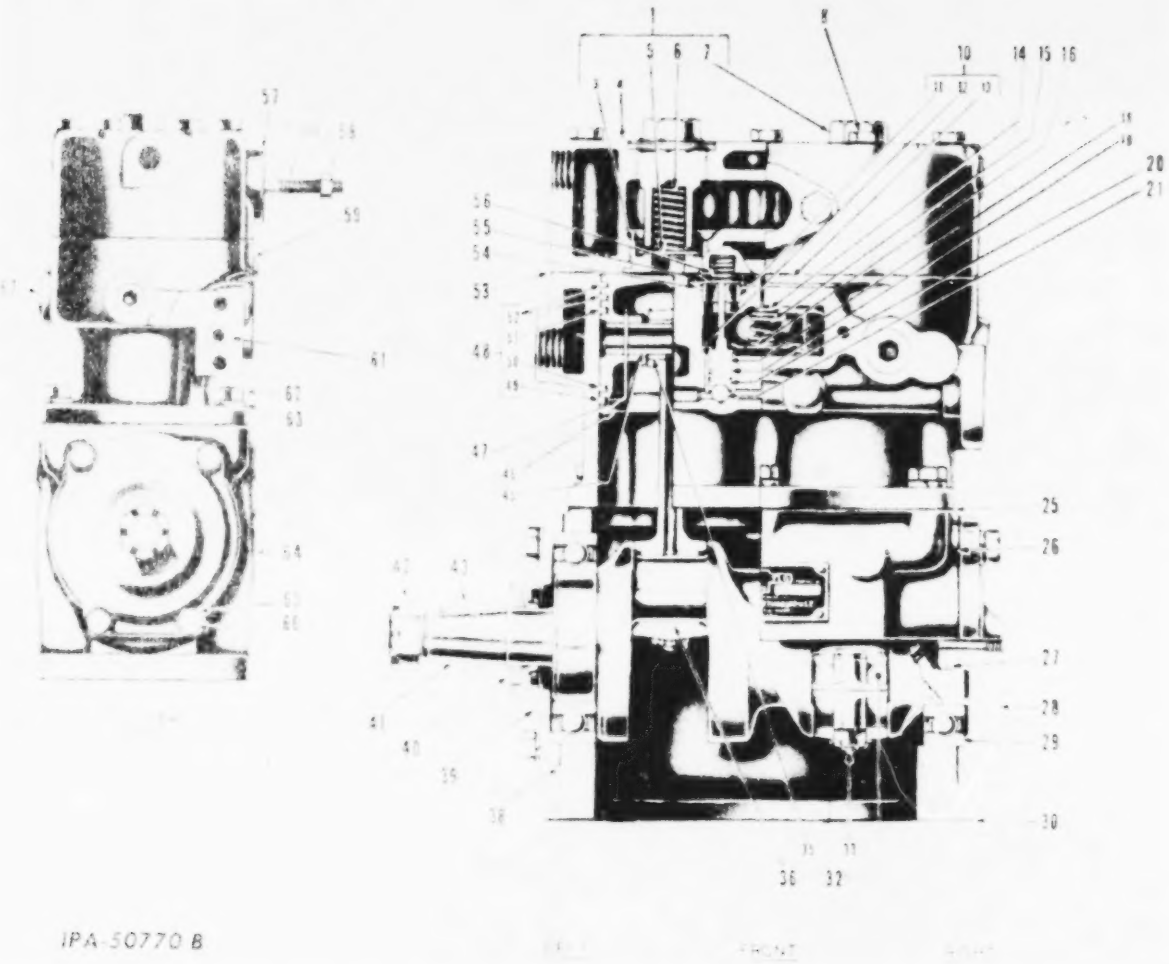



**Fig. 5. Sectional View of Air Compressor**

1. Cylinder Head Assembly
3. Discharged Valve Seat
4. Cylinder Head Body
5. Discharge Valve
6. Discharge Valve Spring
7. Discharge Valve Cap Nut
8. Cap Screw
10. Cylinder Block Body Assembly
11. Inlet Valve Seat
12. Bushing
13. Cylinder Block Body
14. Unloader Spring Seat
15. Unloader Spring
16. Unloader Spring Saddle
18. Unloader Piston
19. Grommet
20. Unloader Cup
21. Unloader Cup Stop
25. Unloader Block Gasket
26. Rear Cover Gasket
27. Oil Seal Ring
28. Rear Cover
29. Ball Bearing
30. Flange Gasket
32. Connecting Rod and Cap Assembly
33. Rod Bolt
35. Wrist Pin Bushing
36. Bearing Insert
37. Front Cover Gasket
39. Front Cover
40. Oil Seal
41. Crankshaft
42. Crankshaft Nut
43. Crankshaft Key
45. Wrist Pin
46. Piston
47. Wrist Pin Lock Wire
48. Piston Ring Set
49. Oil Ring
50. Compression Ring
51. Oil Ring
52. Compression Ring
53. Cylinder Head Gasket
54. Inlet Valve Guide
55. Inlet Valve
56. Inlet Valve Spring
57. Cylinder Head Fitting Gasket
58. Nut
59. Strainer Gasket
61. Plug
62. Cap Screw
63. Lock Washer
64. Crankcase
65. Lock Washer
66. Cap Screw
67. Plug

### 3. DISASSEMBLY

Before starting disassembly, remove all grease and dirt from the exterior of the compressor using cleaning solvent and a brush.

Mark the following items to show their proper relationships prior to disassembly.

a. The cylinder head's relation to the crankcase.

b. The position of the cylinder block in relation to the crankcase.

c. The position of the crankcase end covers in relation to the crankcase.

d. The position of the crankshaft in relation to the crankcase.

**(Refer to Fig. 5)**

1. Remove the cap screws (8) and lift off the cylinder head. Tap the cylinder head with a rawhide hammer to break the gasket joint if necessary.

2. Remove the inlet valve springs (56) from the head, and inlet valves (55) from their guides in the cylinder block (Fig. 7).

3. Scrape off the cylinder head gasket from the cylinder head and block.

4. Remove the discharge valve cap nuts (7) in the cylinder head and lift out the discharge valve springs and discharge valves (Fig. 6).

5. Remove the connecting rod bearing caps (32) and push the pistons with connecting rods attached out the top of the cylinder block (Fig. 7). Replace the caps on each connecting rod. Note that the caps are punch marked to show the proper position of the caps on the rods.

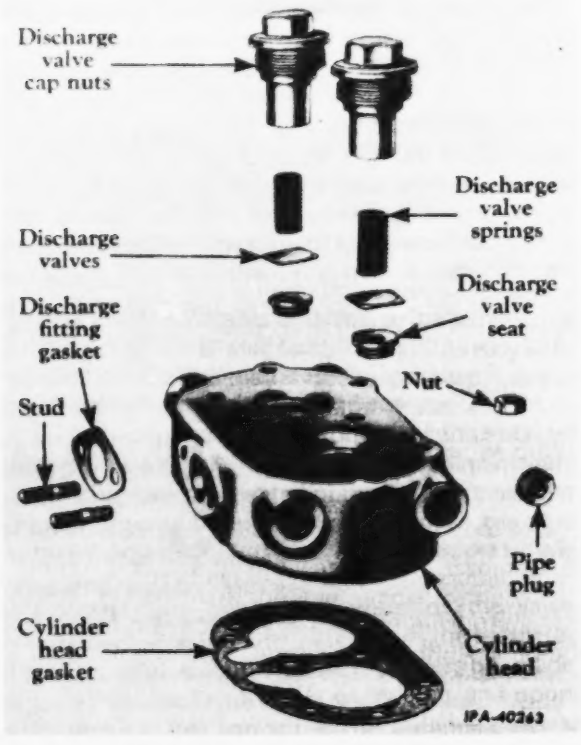



Fig. 6. Exploded View of Cylinder Head

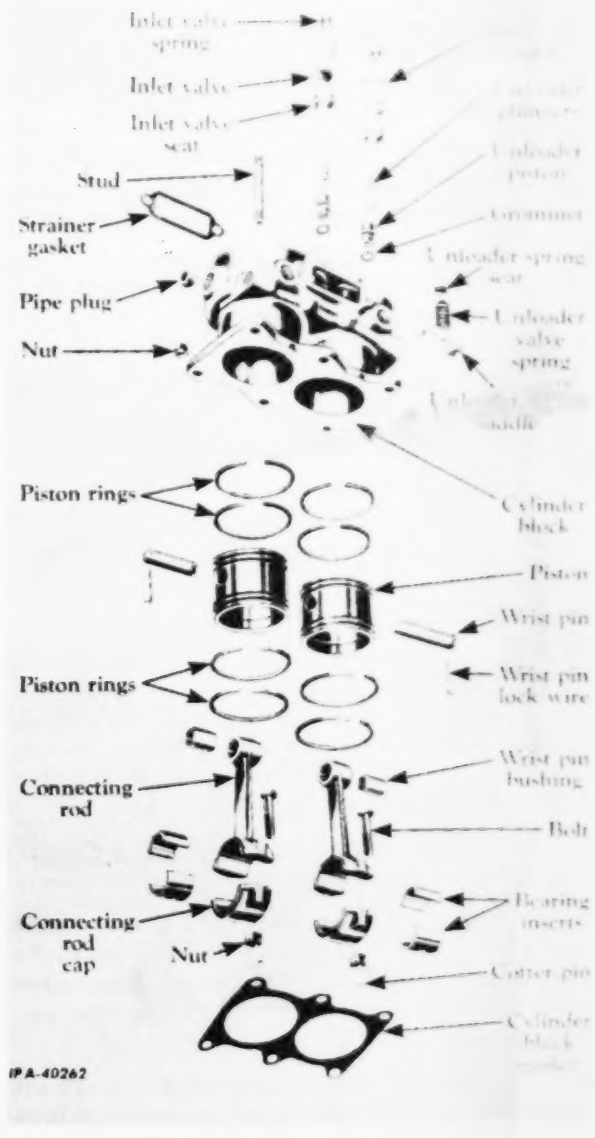



Fig. 7. Exploded View of Cylinder Block

# AIR COMPRESSOR

6. Remove the piston rings (48) from each piston. If the pistons are to be removed from the connecting rods, remove the wrist pin lock wire (47) and press the wrist pin from the piston and connecting rod (Fig. 7).

7. Remove the drive pulley nut (42) and tap the pulley (8, Fig. 4) to remove it from the keyed crankshaft. Remove the key (43) from the crankshaft.

8. Remove the cap screws securing the front cover (39) to the crankcase. Slide the front cover with oil seal off the crankshaft. Do not remove the oil seal from the cover unless it is to be replaced. Remove the cap screws and the rear cover (28) with gasket (26) from the crankcase.

9. Press or drive the crankshaft with ball bearings out of the crankcase from the drive end of the compressor. Ball bearings can be pressed off the crankshaft if necessary to replace them.

10. Remove the cap screws and lock washers (62 and 63) securing the cylinder block to the crankcase and remove the cylinder block and gasket.

11. Remove the unloader valve spring (15), spring saddle (16) and spring seat (14) from the cylinder block. Remove the unloader guides and plungers, and unloader pistons (Fig. 7). If installed, remove the unloader cup (20) and stop (21) (Fig. 5).

**NOTE:** *The disassembled unloader mechanism should be replaced by an unloader kit.*

**NOTE:** *It may be necessary to apply air pressure, with CAUTION, at the governor port (Fig. 1) of the cylinder block to remove the unloader pistons.*

12. Remove the inlet valve seat bushings only if the seats are worn or damaged. Refer to "INSPECTION AND REPAIR" in this section.

## 4. INSPECTION AND REPAIR

1. Wash all parts in an oil solvent and dry thoroughly with compressed air.

2. Put the cylinder head through a cleaning solution to remove all carbon from the discharge valve cavities and to remove all rust and scale from water cavities. Scrape carbon, dirt and particles of old gaskets from all surfaces.

3. Clean thoroughly all oil passages through the crankshaft, connecting rods, crankcase, base plate and end cover. If necessary, prod oil passages with wire and flush with cleaning solvent.

4. Put the cylinder block through a cleaning solution to remove all carbon and dirt from the inlet passages and unloader passages and to remove rust and scale from the water cavity. Scrape particles of old gaskets from all surfaces.

5. Inspect the cylinder head for cracks or breaks. Replace if any are found.

6. Test the water jacket of the cylinder head and cylinder block for leakage using air pressure. Replace the unit if leakage is found.

7. Check the crankcase, cylinder block and end covers for cracks and broken lugs. Replace if any are found.

8. Inspect the ball bearings for wear or flat spots; replace bearings if these conditions exist. Check ball bearing fit in the crankcase. Bearings must be a finger-press fit. If the crankcase bearing bores are worn or damaged, the crankcase should be replaced.

9. Inspect the inlet valves and seats. If the inlet valves are grooved deeper than 0.08mm (0.003 in) where they contact the seat, they should be replaced. Inlet valves not worn excessively or damaged can be reclaimed by lapping them on a piece of crocus cloth on a flat surface. If the inlet valve seats show slight scratches or wear, they can be reclaimed by using a lapping stone, grinding compound, lapping disc and valve grinding tool. If the seats cannot be reclaimed in this manner, they should be replaced. The dimension from the top of the cylinder block to the inlet valve seat should not exceed 0.145 inch nor be less than 2.5mm (0.10 in). After installing new seats, the dimension should be 2.57-2.87mm (0.101 to 0.113 in).

10. Discard old discharge valve springs and replace with new springs. Inspect the discharge valves and discharge valve seats. If the discharge valves are grooved deeper than 0.08mm (0.003 in) where they contact the seats, they should be replaced. If the valves are not worn excessively, they can be cleaned by lapping them on a piece of crocus cloth on a flat surface. If the seats are worn excessively so there is no longer sufficient metal left to reclaim the seat by using a lapping stone, the seats should be replaced. If new discharge valves, springs and cap nuts are installed, the discharge valve travel should be between 1.42-1.78mm (0.056-0.070 in).

11. Test the discharge valves for leakage by applying 100 pounds of air pressure through the discharge port of the cylinder head and applying soap suds to the discharge valve openings in the floor of the cylinder head. Leakage should not exceed a 25mm (1 in) soap bubble in not less than five seconds.

**NOTE:** *If excessive leakage is found, leave the air pressure applied and, using a fiber or hardwood dowel and light hammer, tap the discharge valves off their seats several times to improve the seal between the valves and their seats. If the valves and seats have been reconditioned properly, this will reduce the leakage.*

**NOTE:** *Leakage tests must also be made by applying soap suds around the discharge valve cap nuts with air pressure applied as previously outlined. Leakage at cap nuts is not permissible.*

12. Check the cylinder bores for evidence of excessive wear, out-of-round or scoring. Cylinder bores which are scored or out-of-round more than 0.05mm (0.002 in) or tapered more than 0.08mm (0.003 in) should be rebored or honed oversize. Cylinder bores should be finished honed while bolted to the compressor crankcase if possible. Oversize pistons (.010, .020 and .030) are available. Cylinder bores must be smooth, straight and round.

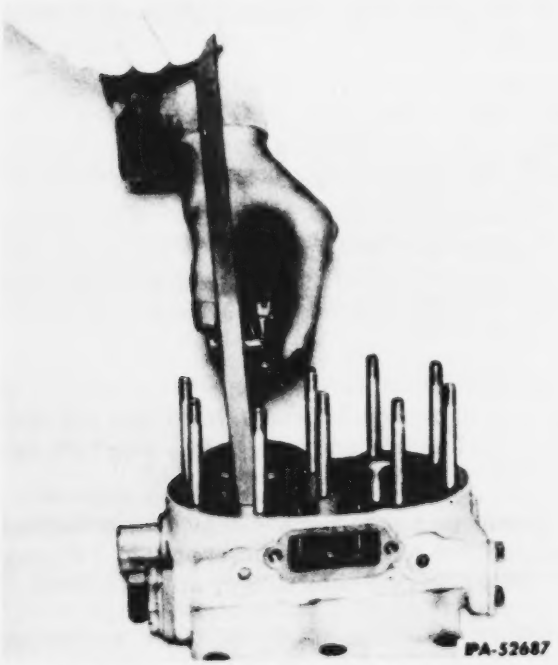



**Fig. 8. Checking Piston and Cylinder Bore Clearance**

13. Inspect the pistons for scores, cracks or damage of any kind. If scores or cracks are found, replace the piston.

**Fig. 9. Checking Piston Ring Groove Clearance**

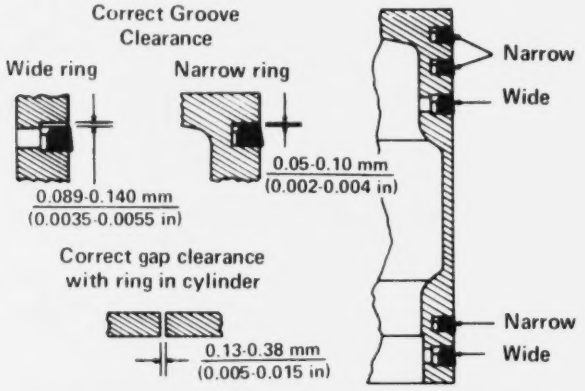
**Fig. 10. Checking Piston Ring Gap**

# AIR COMPRESSOR

14. Check the clearance between the pistons and the cylinder bores with feeler gauge stock (Fig. 8). The clearance should be between 0.05mm (0.002 in) minimum and 0.10mm (0.004 in) maximum.

15. Check the pistons for correct clearance between the rings and the ring grooves (Fig. 9). Also check the ring gap with the rings installed in the cylinder bores (Fig. 10).

The correct ring gap and groove clearance is shown in Fig. 11.




All rings must be located in their proper grooves as shown. The rings can be identified by the width and should be installed with the bevel or the pip mark (if any) toward the top of the piston.

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**Fig. 11. Piston and Clearance of Piston Rings**

16. Check the fit of the wrist pins in the pistons and connecting rods. The wrist pins must be a light press fit in the pistons. If the wrist pin is a loose fit in the piston, the wrist pin, piston or both must be replaced. Check the fit of the wrist pin in the connecting rod bushing by rocking the piston. The clearance of the wrist pin-to-connecting rod bushing should not exceed 0.038mm (0.0015 in). If excessive clearance is apparent, replace the wrist pin bushings in the connecting rods.

17. When pressing new bushings into place, be sure the oil hole in the bushing lines up with the oil hole in the connecting rod. Bushings must then be reamed, honed or bored to provide between 0.0025-0.0152mm (0.0001-0.0006 in) clearance between the bushing and wrist pin.

18.Inspect the connecting rod bearings for proper fit on the crankshaft journals. Check the connecting rod bearings for wear. If worn, cracked or broken, the inserts must be replaced. Connecting rod caps are not interchangeable. Position the caps so the two inserts locking slots are adjacent to the same cap screws.

19. Crankshaft journals which are more than 0.03mm (0.001 in) out-of-round or bruised must be reground. When regrinding, the fillets at the ends of the journals must be maintained. Undersize connecting rod bearing inserts (0.010, 0.020 and 0.030 in) are available for reground crankshafts.

20. Main bearing journals must not be worn sufficiently to prevent the ball bearings being a snug fit.

21. The oil seal ring grooves in the crankshaft must not be worn sufficiently to prevent a good fit on the oil seal rings. Walls of the oil seal ring grooves must be square and have a good finish.

## 5. REASSEMBLY (Refer to Fig. 5)

1. Place a new cylinder block gasket (25) in position on the crankcase. Position the cylinder block on the crankcase according to the markings made prior to disassembly. Install cap screws and tighten securely.

2. Press the ball bearing (29) onto each end of the crankshaft if they were removed. Install the front cover (39) with new oil seal (40), if necessary, and a new gasket (38) to the crankcase. Carefully insert the threaded end of the crankcase through the oil seal (40). Press the crankshaft bearings into the crankcase from the rear of the compressor, being sure the front main bearing bottoms against the front cover.

3. Install a new oil seal ring (27) in the rear cover (28). Place a new cover gasket (26) on the crankcase line up, and install the rear cover to align the oil holes. Tap the cover into place and secure with cap screws.

4. Position the connection rod in the piston and press the wrist pin into the piston with the lock wire holes in the pin aligned with the lock wire holes in the piston.

5. Install new wrist pin lock wire in the wrist pin so the long end extends through the piston and wrist pin. Snap the short end into the lock wire hole near the bottom of the piston skirt (Fig. 12).

6. Install the piston rings in their proper location and, with the pip marks or bevel up (Fig. 11), stagger the piston ring gaps so they are not in line.

7. Before installing the pistons and connecting rods, thoroughly lubricate the pistons, piston rings, wrist pin bushings and connecting rod bearings with clean engine oil.

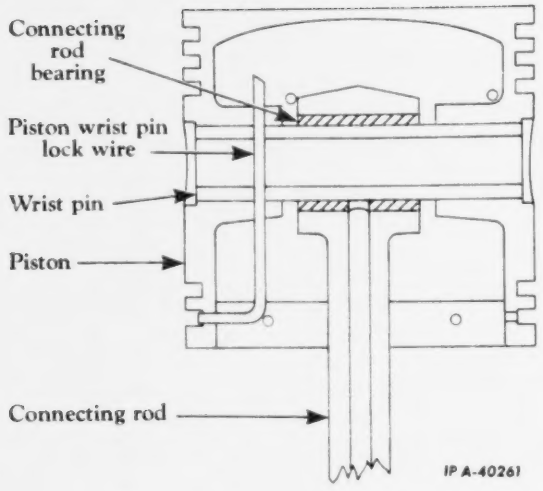



**Fig. 12. Method of Installing Wrist Pin Lock Wire**

8. Turn the crankshaft so as to position one crankshaft journal downward. Remove the bearing cap from one connecting rod, leaving the connecting rod bolts in the rod.

9. Using a ring compressor, install the connecting rod and piston through the top of cylinder whose journal is down. Push the piston down until the connecting rod bearing makes contact with the crankshaft journal.

10. Install the connecting rod bearing cap. Be sure the aligning marks on the cap and rod coincide. If the cap and rod are not marked, position the cap on the rod so the two locking slots in the bearing inserts, rod and cap are both lo ated adjacent to the same connecting rod bolt. Secure the cap to the rod with castellated nuts and cotter pins. Install the other connecting rod and piston in the same manner.

11. Lubricate the unloader piston bores in the cylinder block with clean engine oil.

**NOTE:** *The new unloader pistons in the replacement kit are already lubricated with a special lubricant. Do not remove this lubricatien.*

12. Install the new unloader pistons (18) lubricated as received, in their bores using caution against cutting the piston "O" rings for distorting the spiral back-up rings. Position the unloader plungers in their guides and slip them in over the tops of the pistons (Fig. 7).

13. Install the unloader spring seat (14) in the cylinder block; a small hole is drilled in the block for this purpose. Position the saddle (16) between the unloader piston guides so its forks are centered on the guides (Fig. 7). Install the unloader spring (15), being sure it seats over the spring seats both in the block and on the saddle.

14. Install the inlet valve seats (11) if they were removed from the cylinder block. Position and install the inlet valve guides (54); then drop the inlet valves (55) into their guides (Fig. 7). There should be a loose sliding fit between the guides and valves.

15. If removed, install the discharge valve seats (3). Install the discharge valves, springs and valve cap nuts in the cylinder head (Fig. 6).

16. Place the inlet valve springs (56) in the cylinder head. Use a small amount of grease to keep them from falling out when the head is inverted to install it on the cylinder block. Place a new cylinder head gasket on the block. Carefully align the inlet valve springs with the inlet valve guides in the cylinder block as it is placed on the cylinder block. Secure the cylinder head to the block with the cylinder head bolts. Tighten these bolts evenly.

17. Install the key and drive pulley to the crankshaft; add and tighten the nut (42), and lock with the cotter pin.

## 6. TESTING REBUILT COMPRESSOR

In order to properly test a compressor under operating conditions, a test bench similar to the one shown in Fig. 13 is necessary for properly mounting, cooling, lubricating and driving the compressor. If such facilities are available, the oil supply line must furnish at least 103 KPa (15 psi) during all tests and the crankcase kept drained of oil during the tests. A water circulating system must be provided.

1. RUN-IN TEST: Run the compressor for one half hour at 1750 rpm with the compressor discharge port open to atmosphere. Check during the run for oil leaks, overheated bearings and excessive noise.

2. EFFICIENCY TEST: This test is made by running the compressor for one half hour at 1750 rpm connected to a reservoir fitted with an orifice type exhaust fitting. The size of the orifice in this fitting should be 2.26mm (0.089 in). The compressor should maintain a minimum pressure of 517 KPa (75 psi) in the reservoir during this test. For this test, valves No. 1 and No. 4 should be closed and valve No. 2 opened (Fig. 13).

# AIR COMPRESSOR

3. COMPRESSOR UNLOADING MECHANISM TEST: A test to check the compressor unloading mechanism can be made by closing valves No.1 and No. 2 and opening valve No. 3 and No. 4 (Fig. 13). Run the compressor until the unloading mechanism operates, stopping further compression of air. This should occur at an air pressure not greater than 862 KPa (125 psi) as noted on the reservoir air pressure gauge.

### 7. INSTALLATION (Refer to Fig. 4)

1. Using a new gasket install the air compressor to the mounting base (9).

2. Connect the lube oil inlet hose (18) to the compressor.

3. Connect the water outlet hose (1) and inlet hose (4) to the compressor.

4. Loosen the hardware securing mounting base (9) to plate (11) and position the compressor for installing belt (12) on pulley (8). (Refer to the Operator's Manual for "ADJUSTING BELT TENSION.") Retighten hardware.

## AIR COMPRESSOR (TU-FLO 1000)

### 8. DESCRIPTION

**NOTE:** *Refer to the Chassis Service Manual for detailed information on the air governor.*

**General**

The TU-FLO 1000 air compressor is used on the model 560 Pay loader.

The air compressor is a single stage, reciprocating four cylinder V-type design with automatic inlet valves. The rated capacity of the compressor is 0.680m³ (24 cubic feet) per minute, which is based on the piston displacement with the compressor running at a speed of 1250 rpm.

The compressor cylinder heads and blocks are water cooled by the coolant from the engine cooling system.

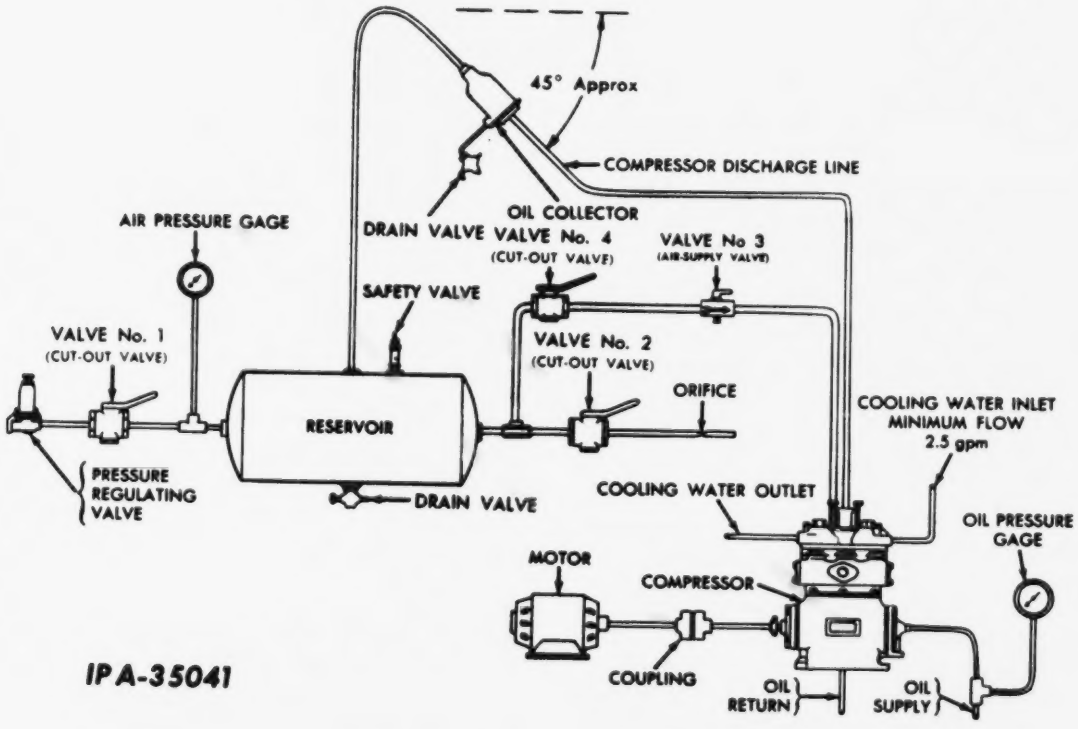



**Fig. 13. Sketch of Test Bench for Compressor**

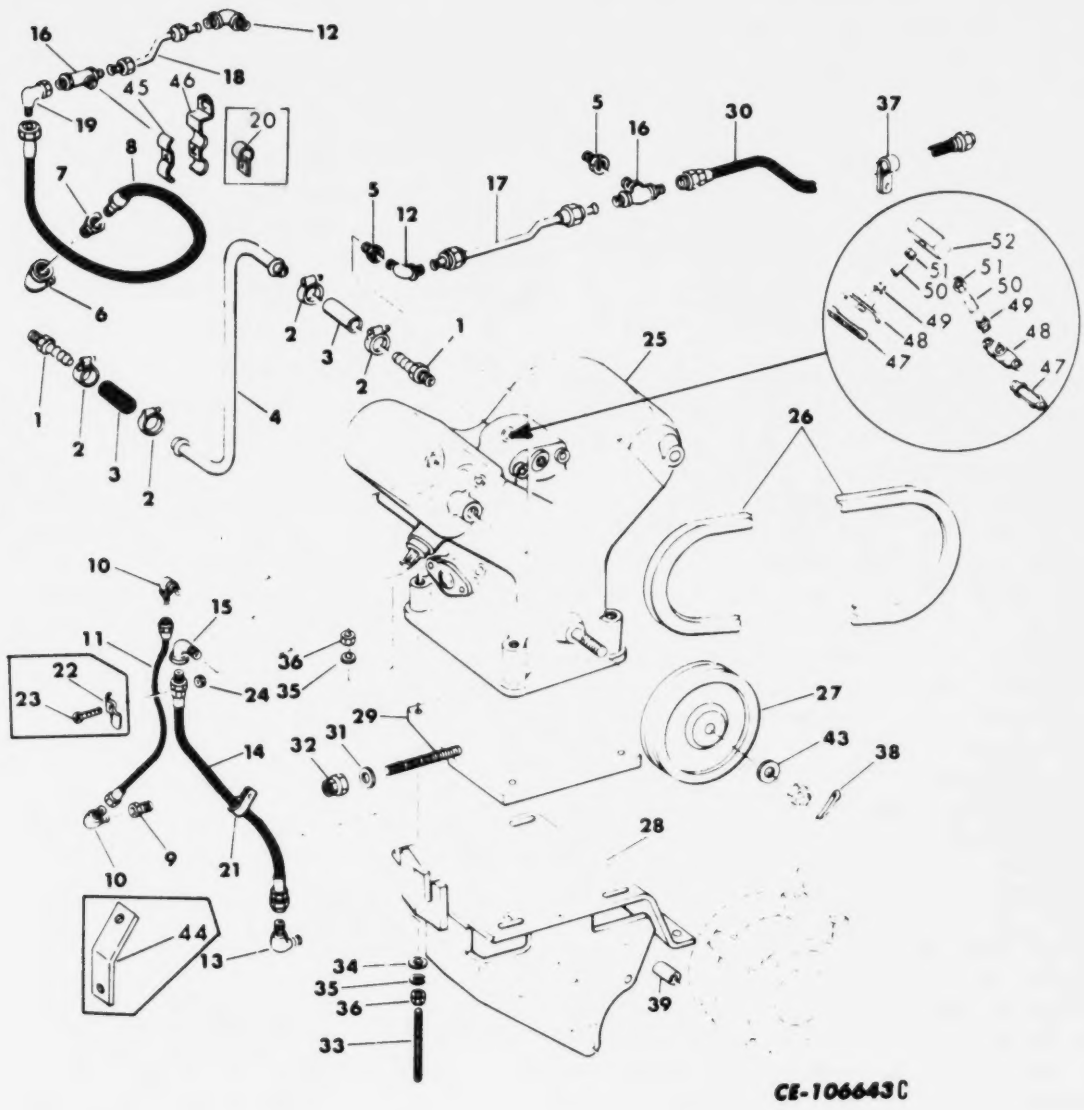



**Fig. 14. Air Compressor and Related Parts**

1. Supply Tube Fitting
2. Clamps
3. Hose
4. Supply Tube
5. Bushing
6. Elbow
7. Bushing
8. Water Inlet Hose
9. Bushing
10. Elbows
11. Lube Oil Inlet Hose
12. Elbows
13. Elbow
14. Lube Oil Outlet Hose
15. Elbow
16. Tees
17. Water Outlet Tube
18. Water Inlet Tube
19. Elbow
20. Clamp
21. Clip
22. Clamp
23. Screw
24. Nut
25. Air Compressor
26. Air Compressor Belt
27. Pulley
28. Mounting Bracket
29. Base
30. Water Outlet Hose
31. Washer
32. Lock Nut
33. Stud
34. Washer
35. Washer
36. Nut
37. Clamp
38. Cotter Pin
39. Spacer
43. Washer
44. Support
45. Clamp
46. Clamp
47. Gasket
48. Adapter Plate
49. Connector
50. Sleeve
51. Nut
52. Air Inlet Adapter

# AIR COMPRESSOR

The compressor is lubricated by the engine lubricating oil. The crankshaft has an oil passage in which the oil is forced through and out around each connecting rod journal. This oil is also used to lubricate the cylinder bores and crankshaft bearings. The wrist pins and bushings are lubricated by an oil dripping method from the piston through the rod. Surplus oil returns to the engine crankcase through the compressor crankcase.

**Operation**

The compressor runs continuously while the engine is running, but the actual compression of air is controlled by the governor. The governor, acting in conjunction with the unloading mechanism in the compressor cylinder block, starts or stops the compression of air by unloading or loading the compressor when the pressure in the air system reaches the desired minimum of 655-725 KPa (95-105 psi) or 725-862 KPa (105-125 psi) maximum.

COMPRESSING AIR (LOADED): During the down stroke of each piston, a partial vacuum is created above the piston which unseats the inlet valve, allowing air drawn through the intake port to enter the cylinder above the piston, (Fig. 1). As the piston starts the upward stroke, the air pressure on top of the inlet valve, plus the inlet valve return spring force, closes the inlet valve. The air above the piston is further compressed until the pressure lifts the discharge valve and the compressed air is discharged through the discharge line into the reservoir (Fig. 2). As each piston starts its down stroke, the discharge valve above it returns to its seat, preventing the compressed air from returning to the cylinder, as the intake and compression cycle is repeated.

NOT COMPRESSING AIR (UNLOADED): When the air pressure in the reservoir reaches the maximum setting of the governor (725 to 862 KPa — 105 to 125 psi), compressed air from the reservoir passes through the governor into the cavity below the unloading pistons in the compressor cylinder block. This air pressure lifts the unloading pistons which in turn lift the inlet valves off their seats (Fig. 3).

PASSAGE OR AIR DURING NON-COMPRESSION: With the inlet valves held off their seats, the air during each upstroke of the piston is forced through the air inlet cavity and down to the other cylinders where the piston is on the down stroke. When the air pressure in the reservoir is reduced to the minimum setting of the governor (655 to 725 KPa — 95 to 105 psi), the governor releases the air pressure beneath the unloading pistons. The unloading piston return spring then forces the piston down and the inlet valve springs return the inlet valves to their seats and compression is resumed.

**9. REMOVAL (Refer to Fig. 14)**

1. Remove water outlet tube (17).

2. Disconnect the following items at the compressor: water outlet hose (30), water inlet hose (8), lube oil inlet hose (11) and lube oil outlet hose (14).

3. Disconnect supply tube (4) at the compressor by loosening clamp (2).

4. Remove water inlet tube (18).

5. Remove hardware (31), (32), (34), (35) and (36) at the mounting bracket (28) and adjust the compressor so that belt (26) can be removed from pulley (27).

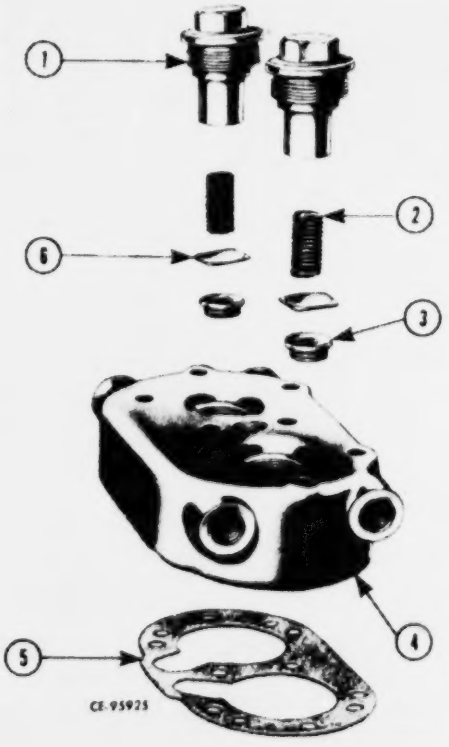



**Fig. 15. Exploded View of Cylinder Head**

1. Discharge Valve Cap Nuts
2. Discharge Valve Springs
3. Discharge Valve Seat
4. Cylinder Head
5. Cylinder Head Gasket
6. Discharge Valves

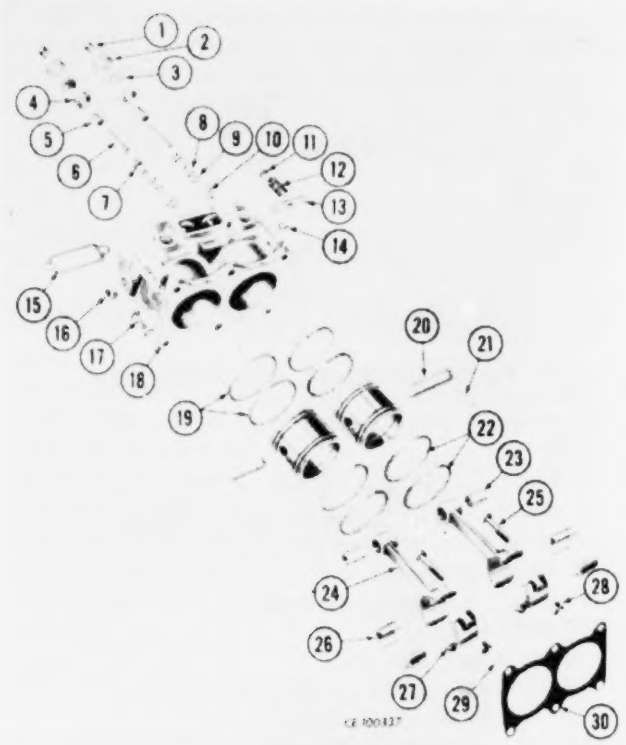


Fig. 16. Cylinder Block — Exploded View

1. Valve Spring
2. Valve Guide
3. Valve
4. Valve Seat
5. Plunger Guide
6. Plunger
7. Piston
8. Back-Up Ring
9. Grommet
10. Bushing
11. Unloader Spring Seat
12. Spring
13. Saddle
14. Plug
15. Gasket
16. Plug
17. Cap Screw and Lock Washer
18. Cylinder Block
19. Upper Piston Rings
20. Wrist Pin
21. Wrist Pin Lock Wire
22. Lower Piston Rings
23. Wrist Pin Bushing
24. Connecting Rod
25. Connecting Rod Bolt
26. Connecting Rod Bearing
27. Rod Bearing Cap
28. Nut
29. Cotter Pin
30. Gasket

6. Remove the remaining hardware (35) and (36) securing the air compressor and remove compressor (25) from base (29).

## 10. DISASSEMBLY

Before starting disassembly, remove all grease and dirt from exterior of compressor, using cleaning solvent and a brush.

Mark the following items to show their proper relationships prior to disassembly:

a. Position of cylinder heads in relation to cylinder blocks.

b. Position of cylinder blocks in relation to crankcase.

c. Position of end covers in relation to crankcase.

d. Position of crankshaft in relation to crankcase.

1. Remove cap screws securing cylinder heads to cylinder block and lift off cylinder heads. Cylinder heads may have to be tapped with a rawhide hammer to break the gasket joints.

2. Remove discharge valve cap nuts (1, Fig. 15) and lift out discharge valve springs (2), and discharge valves (6). Discharge valve seats (3) can be removed, but it is unnecessary unless they are badly worn or nicked.

3. Remove inlet valve springs (1, Fig. 16) and inlet valves (3) from cylinder block (18).

4. Remove hardware (20, Fig. 17) securing baseplate (19) to crankcase (12). Remove baseplate and gasket (18). Discard used gasket.

5. Remove cotter pins (29, Fig. 16) and nuts (28) from connecting rod bolts (25). Remove bolts. Note that bearing caps (27) are punch marked to indicate proper position of caps on rods. Remove caps and push pistons with connecting rods (24) attached out top of cylinder block (18). Replace bearing caps on connecting rods.

6. Remove piston rings (19, 22, Fig. 16) from each piston. Discard used rings. If pistons are to be removed from connecting rods, remove wrist pin lock wire (21) and press wrist pin (20) from piston and connecting rod. Discard lock wires.

7. Remove cotter pin (1, Fig. 17) and nut (2) securing drive pulley to crankshaft (9). Remove pulley (27, Fig. 14) with a gear puller. Remove key (8, Fig. 17) from crankshaft. Remove cap screws (17) securing rear end cover (16) to crankcase (12). Slide rear end cover and gasket (14) off crankshaft. Remove "O" ring (15) from end cover. Discard used gasket and "O" ring.

8. Remove cap screws (3, Fig. 17) securing front end cover (5) to crankcase. Remove end cover and gasket (6). Discard used gasket. Use a rawhide hammer to drive crankshaft from crankcase. Press bearings (7, 13) from crankshaft.

9. Remove cap screws (17, Fig. 16) securing cylinder blocks (18) to crankcase. Separate cylinder blocks from crankcase. Remove and discard gaskets (30).

10. Remove unloader spring (12, Fig. 16), spring saddle (13) and spring seat (11) from cylinder blocks.

11. Remove plunger guides (5, Fig. 16) and plungers (6). Using shop air pressure blow unloader pistons (7) out of cylinder block bores. Use CAUTION during this operation.

12. Remove inlet valve guides (2, Fig. 16). Remove inlet valve seats (4) and unloader bushings (10) if replacement is required.

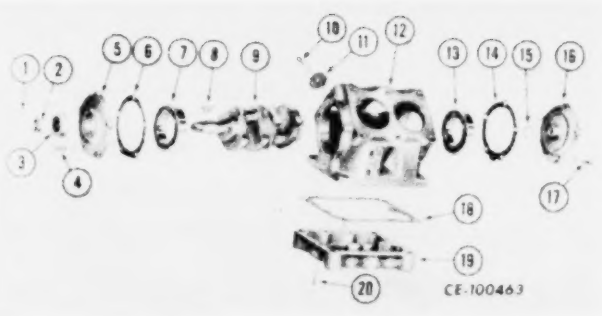



**Fig. 17. Crankcase — Exploded View**

1. Cotter Pin
2. Nut
3. Oil Seal
4. Cap Screw and Lock Washer
5. Front End Cover
6. Gasket
7. Crankshaft Bearing
8. Key
9. Crankshaft
10. Cap Screw and Lock Washer
11. Breather Cover Plate
12. Crankcase
13. Cranksaft Bearing
14. Gasket
15. "O" Ring
16. Rear End Cover
17. Cap Screw and Lock Washer
18. Gasket
19. Base Plate
20. Cap Screw and Lock Washer

## 11. INSPECTION AND REPAIR

1. Wash all parts in an oil solvent, and dry thoroughly with compressed air.

2. Scrape cylinder head gaskets off cylinder heads and block.

3. Put cylinder heads through a cleaning solution to remove all carbon from discharge valve cavities and to remove all rust and scale from water cavities. Scrape carbon, dirt and particles of old gaskets from all surfaces.

4. Clean thoroughly all oil passages through crankshaft, connecting rods, crankcase, base plate and end cover. If necessary, prod oil passages with wire and flush with cleaning solvent.

5. Inspect cylinder heads for cracks or breaks. Replace if any are found.

6. Test water jacket of cylinder heads and cylinder blocks for leakage, using air pressure. Replace unit if leakage is found.

7. Check crankcase, cylinder blocks and end covers for cranks and broken lugs. Replace if any are found.

8. With cylinder blocks installed on crankcase, check fit of bearings in crankcase bearing bores. They must be a tight press fit. The crankcase should be replaced if bores are worn or damaged.

9. Check fit of unloading pistons and piston "O" rings in cylinder block for excessive wear. New "O" rings or grommets should be installed after which unloading pistons should be a neat sliding fit in their bores. Bores must not be scratched or damaged in any way which might accelerate "O" ring wear.

**NOTE:** *If bushing bores are worn or damaged, bushings can be removed by running a 1/8" pipe thread tap inside the bushing, then inserting a 1/8" pipe threaded rod and pulling the bushing straight up and out. Do not use an easy-out for removing these bushings.*

10. Check unloading piston return spring for a permanent set. If spring does not have sufficient tension to return unloader pistons to the loaded position, replace unloader unit.

11. Inspect inlet valves and seats. Inlet valves not worn excessively or damaged, can be reclaimed by lapping them on a piece of crocus cloth on a flat surface. If valve seats show signs of slight scratches or wear they can be reclaimed by using a lapping stone, grinding compound, lapping disc and valve grinding tool. If seats cannot be reclaimed in this manner, they should be replaced. Dimension from top of cylinder block to inlet valve seat should not exceed 3.68mm (0.145 in). After installing new seats, the dimension should be 2.57-2.87mm (0.101)0.113 in). Discard old discharge valve springs and replace with new springs. Inspect discharge valves and discharge valve seats. If discharge valves are not worn excessively, they can be cleaned by lapping them on a piece of crocus cloth on a flat surface. If seats are worn excessively so there is no longer sufficient metal left to reclaim seat, they should be replaced. If new discharge valves, springs and cap nuts are installed, discharge valve travel should be 1.42-1.78mm (0.056-0.070 in).

12. Test discharge valves for leakage by applying 690 kPa (100 psi) of air pressure through discharge port of cylinder head. Apply soap suds to discharge valve openings. Leakage in the forming of soap bubbles is permissible (See NOTES).

**NOTE:** *If excessive leakage is found, leave air pressure applied and using a fiber or hardwood dowel and light hammer, tap discharge valves off their seats several times to improve seal between valves and their seats. If valves and seats have been reconditioned properly, this will reduce leakage.*

**NOTE:** *Leakage tests must also be made by applying soap suds around discharge valve cap nuts, with air pressure applied as above. Leakage at cap nuts is not permissible.*

13. Check cylinder bores for evidence of excessive wear, out-of-round or scoring. Cylinder bores which are scored or out-of-round more than 0.05mm (0.002 in) or tapered more than 0.08mm (0.003 in) should be rebored or honed oversize. Cylinder bores should be finished honed while bolted to the compressor crankcase if possible. Oversize pistons (0.010, 0.020 and 0.030 in) are available. Cylinder bores must be smooth, straight and round.

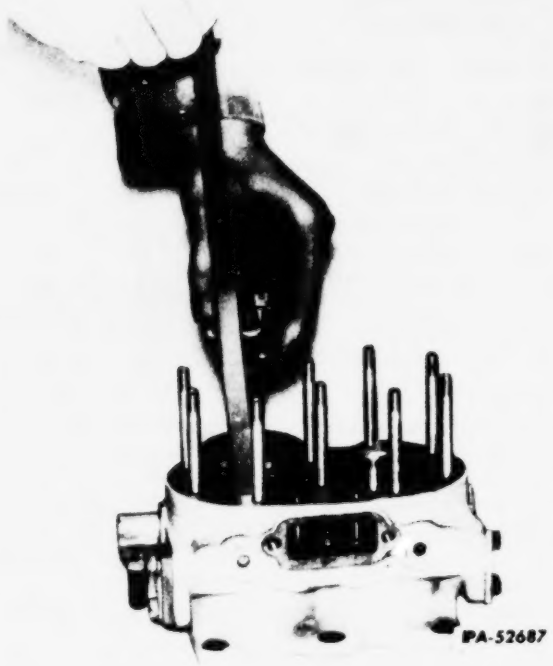



**Fig. 18. Checking Piston and Cylinder Bore Clearance**

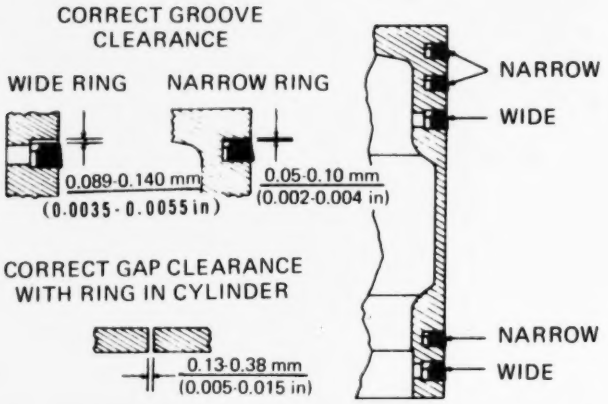
14. Inspect pistons for scores, cracks or damage of any kind. If scores or cracks are found, replace piston.

15. Check clearance between pistons and cylinder bores with a feeler gauge (Fig. 18). Clearance should be 0.05-0.10mm (0.002-0.004 in).

16. Install piston rings in their proper location and with pip marks or bevel up. Stagger piston ring gaps 180° so that they are not in line.

17. Check pistons for correct clearance between rings and ring grooves (Fig. 20). Also check ring gap with rings installed in cylinder bores (Fig. 21). The specifications for clearances are given in Fig. 19.

18. Check fit of wrist pins in pistons and connecting rods. Wrist pins must be a light press fit in pistons. If wrist pin is a loose fit in piston, wrist pin, piston or both must be replaced. Check fit of wrist pin in connecting rod bushing by rocking piston. Clearance of wrist pin to connecting rod bushing should not exceed 0.003-0.015mm (0.0001-0.0006 in). If excessive clearance is apparent, replace wrist pin bushings in connecting rods (See NOTE).




All rings must be located in their proper ring grooves as shown. The rings can be identified by the width and should be installed with the bevel or the pip mark (if any) toward the top of the piston. This applies to Cast Iron Pistons (only as shown above).

CE-100470A

Die Cast Pistons use five (5) narrow rings.

**Fig. 19. Piston Ring Grooves**

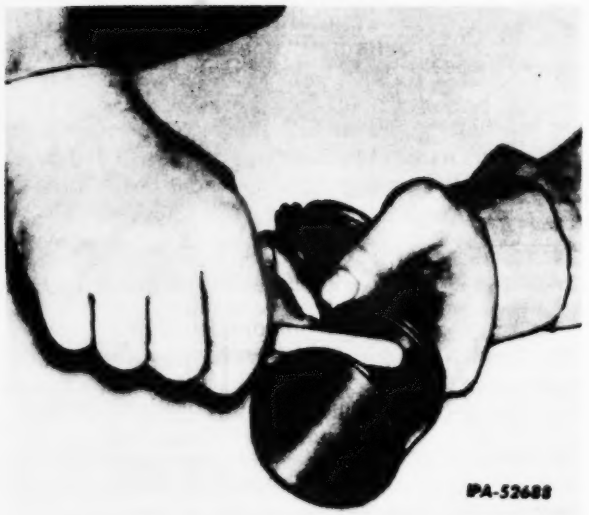



**Fig. 20. Checking Piston Ring Groove Clearance**

**NOTE:** *When pressing new bushings into place, be sure that oil hole in bushing lines up with oil hole in connecting rod. Bushings must then be reamed, honed or bored to provide specified clearance between bushing and wrist pin as stated above.*

19. Inspect connecting rod bearings for proper fit on crankshaft journals. Also check connecting rod bearings for wear. If worn, cracked or broken, inserts must be replaced. Connecting rod caps are not interchangeable. Position caps so that two insert locking slots are adjacent to same cap screws.

**Fig. 21. Checking Piston Ring Gap**

20. Out-of-round crankshaft journals which are more than 0.03mm (0.001 in) must be reground. When regrinding, fillets at ends of the journals must be maintained. Undersize connecting rod bearing inserts (.010, .020 and .030) are available. Check to be sure oil passages are open and clean through crankshaft.

21. Main bearing journals must not be worn sufficiently to prevent being a press fit into bearings.

22. Inspect crankshaft bearings for wear or flat spots. Replace bearings if these conditions exist.

## 12. REASSEMBLY

1. Place a new cylinder block gasket (30, Fig. 16) in position on crankcase. Position cylinder block on crankcase according to marking made prior to disassembly. Install cap screws and tighten securely.

2. Position crankshaft bearings (7, 13, Fig. 17) and crankshaft (9) in crankcase (12) being sure drive end of crankshaft is positioned as marked before disassembly.

3. Carefully press crankshaft and bearings into crankcase, using an arbor press. Rotate crankshaft to be sure it is not binding. Position a new rear end cover gasket (14, Fig. 17) on crankcase, making sure oil hole in gasket lines up with oil hole in crankcase. Installl new "O" ring (15) on end cover (16). Position end cover on crankcase, being sure end cover is correctly positioned in relation to oil holes in gasket and crankcase. Secure end cover to crankcase with cap screws (17) and lock washers. Tighten securely.

4. Press a new oil seal (3, Fig. 17) into front end cover (5) being sure lip of seal faces toward crankcase. Position new gasket (6) on crankcase. Carefully install end cover over crankshaft and on crankcase, avoiding damage to seal. Attach cover with cap screws (4) and lock washers. Tighten securely.

5. Position connecting rod in piston and press wrist pin into piston with lock wire holes in pin aligned with lock wire holes in piston.

6. Install new wrist pin lock wire in wrist pin so that long end extends through piston and wrist pin. Snap short end into lock wire hole near bottom of piston skirt (Fig. 22).

**NOTE:** *Before installing pistons and connecting rods, thoroughly lubricate pistons, piston rings, wrist pin bushings and connecting rod bearings with clean engine oil.*

7. Turn crankshaft so as to position one crankshaft journal downward. Remove bearing cap from one connecting rod leaving connecting rod bolts in rod.

8. Using a ring compressor, install connecting rod and piston through top of cylinder. Push piston down until connecting rod bearing makes contact with crankshaft journal.

9. Install connecting rod bearing cap. Be sure that aligning marks on cap and rod coincide. If cap and rod are not marked, position cap on rod so that two locking slots in bearing inserts, rod and cap are both located adjacent to same connecting rod bolt. Secure cap to rod with bolts and lock washers. Tighten bolts evenly. Bend lock washer prongs up against bolt heads. Install other connecting rod and piston in same manner.

10. Lubricate unloader piston cavity in cylinder block (10, Fig. 16), unloader piston (1, Fig. 23), back-up ring (3) and grommet (2) with special lubricant "Dimethyl Polysiloxane" (See NOTE).

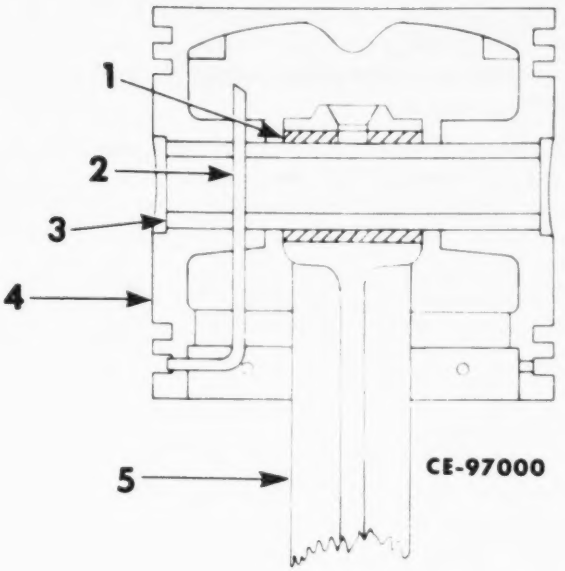



**Fig. 22. Method of Installing Wrist Pin Lock Wire**

1. Pin Bushing
2. Lock Wire
3. Pin
4. Piston
5. Connecting Rod

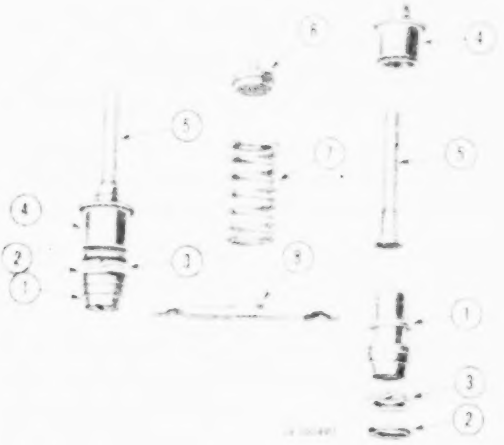


**Fig. 23. Unloader Mechanism**

1. Piston
2. Grommet
3. Back-Up Ring
4. Plunger Guide
5. Plunger
6. Spring Seat
7. Spring
8. Saddle

# AIR COMPRESSOR

**NOTE:** *Order lubricant from compressor manufacturer.*

11. Carefully install back-up rings and grommets on unloader pistons.

12. Install unloader pistons in their bores carefully to avoid cutting grommets or distorting back-up rings. Position unloader plungers (5, Fig. 23) in their guides (4) and slip them in and over tops of pistons.

13. Install spring seat (6, Fig. 23) in cylinder block. (Cylinder block has a small hole drilled for this purpose.) Position saddle (8) between plunger guides (4) so forks are centered on guides. Install spring (7), being sure it seats over spring seat (6) in block and on saddle.

14. Install inlet valve seats (4, Fig. 16) if previously removed. Install inlet valve guides (2), then drop inlet valves (3) in guides. There should be a loose sliding fit between guides and valve.

15. If previously removed, discharge valve seats (3, Fig. 15) should be installed in cylinder head (4).

16. Drop discharge valves (6, Fig. 15) into their seats. Insert inlet valve springs (2) in cylinder head. Use a small amount of grease to hold springs in cylinder head.

17. Place a new cylinder head gasket (5, Fig. 15) on block. Carefully align inlet valve springs with inlet valve guides in cylinder head as it is placed on cylinder block. Secure cylinder head to block with cylinder head bolts. Tighten these bolts evenly.

18. Install key (8, Fig. 17) in crankshaft (9). Install pulley (27, Fig. 14) and crankshaft nut (2, Fig. 17). Use a new cotter pin (1) to lock nut to crankshaft.

19. Using a new gasket (18, Fig. 17), replace base plate (19) on crankcase (12). Install and tighten cap screws (20) and lock washers evenly and securely.

## 13. TESTING REBUILT COMPRESSOR

In order to properly test a compressor under operating conditions, a test bench is necessary for properly mounting, cooling, lubricating and driving the compressor. If such facilities are available, the oil supply line must furnish at least 105 KPa (15 psi) during all tests and the crankcase kept drained of oil during the tests. Water for cooling, at a minimum flow rate of 9.5 l/min (2-1/2 gpm) must also be provided.

1. Connect an air reservoir to the discharge port. Air reservoir volume plus connecting line volume should be 21300cm$^3$ (1300 cubic inches).

2. Run compressor at 1700-1750 rpm. Elapsed time for compressor to build up from 0-690 kPa (0-100 psi) should be a maximum of 15 seconds.

**NOTE:** *During the test the compressor should be checked for oil leakage and noisy operation.*

## 14. INSTALLATION (Refer to Fig. 14)

1. Install the air compressor (25) to base (29) and secure hardware. Leave hardware (31), (32), (34), (35) and (36) at mounting bracket (28) loose.

2. Adjust compressor to install belt (26) on pulley (27). (Refer to the Operator's Manual for "ADJUSTING BELT TENSION.") Tighten hardware (31, (32), (34), (35) and (36) to mounting bracket (28).

3. Install water inlet tube (18).

4. Connect supply tube (4) at the compressor and tighten clamp (2).

5. Install water outlet tube (17).

6. Connect the following items at the compressor: lube oil outlet hose (14), lube oil inlet hose (11), water inlet hose (8) and water outlet hose (30).

# STORAGE BATTERIES



## 1. GENERAL

A storage battery is an electrochemical device for converting chemical energy into electrical energy. The battery has three major functions:

a. To provide a source of current for cranking the engine.

b. To act as a stabilizer to the voltage in the electrical system.

c. It can, for a limited period, furnish current when the electrical demands of the vehicle exceed the output of the alternator.

The amount of energy that a fully charged battery can produce depends primarily upon the size and number of the plates.

The total energy that a good battery can produce when at full charge is indicated by its reserve capacity rating. A 120 minute reserve capacity battery has greater capacity for storing energy and doing work than a 100 minute reserve capacity battery because the 120 minute battery has larger plates or a greater number of plates.

The reserve capacity rating of a battery is usually stamped or printed on the battery case.

A battery should be maintained at not less than 3/4 full charge in normal operation. If it is found that the battery is less than 3/4 charged, it is almost certain that some condition exists which should be corrected.

## 2. COMMON CAUSES OF BATTERY FAILURE

1. Resistance in the charging circuit.

2. Defective alternator or slipping alternator drive belt.

3. Improper regulator adjustment, or faulty regulator.

4. Overload due to defective starting system, or excessive use of accessories.

5. Dirt and electrolyte on top of battery causing a constant drain.

6. Hardened battery plates, commonly called "sulphation," due to the battery being in a low state of charge over a period of time.

7. Physical defects such as shorted cells, loss of active material from the plates, warped plates, broken terminals, etc.

It is important to note that, of the seven common causes of battery failure listed, the first five causes are outside the battery. Any one of these conditions will result in a battery being at less than normal state of charge.

The sixth cause listed can result from any one of the first five causes. That is, sulphation occurs when any condition causes the battery to be undercharged for long periods of time. When a battery becomes sulphated, it will not accept a normal rate of charge and also, its capacity decreases. Sulphation can usually be overcome by prolonged slow charging or by discharging the battery completely, letting it stand discharged for 6 to 12 hours, and then recharging it slowly.

The causes of battery failure listed in Step 7 are the defects that can occur in the battery itself. If shorted cells or loss of active material from the plates occurs when the battery has been in service for less than its guaranteed life, it is usually a result of overworking or overcharging of the battery. Cracked cases, broken terminals and, also, shorted cells can be caused by improper handling of the battery or a faulty battery carrier.

**NOTE:** *When a battery fails, do not be satisfied to merely recharge or replace it. Find the cause of failure and prevent recurrence of the touble.*

## 3. BATTERY VISUAL INSPECTION

The battery should always be very carefully inspected before the actual testing is done. Many undesirable conditions can be seen and corrected before they result in battery trouble. Other visible indications are very important when analyzing the hydrometer readings.

### Procedure

1. Inspect the battery case for cracks and leaks.

2. Inspect battery posts, clamps and cables for breakage, loose connectons, corrosion, and other faults.

3. Note whether the top of the battery is clean and dry. Dirt and electrolyte on top of the battery causes excessive self-discharge.

4. Be sure that the cell vents are open.

5. Be sure that the battery carrier is solidly mounted and in good condition and that the battery hold-down is properly tightened. A loose battery carrier or battery hold-down will allow the battery to be damaged by vibration and jarring. An excessively tightened battery hold-down may buckle or crack the battery case.

# STORAGE BATTERIES

6. Inspect battery for raised cell covers or warped case which may indicate that the battery has been overheated or overcharged at some time. This may be important when analyzing the results of the electrical tests.

7. Inspect electrolyte level. If electrolyte is below the top of the plates, add water. If not below the plates, make hydrometer test before adjusting electrolyte level.

8. Note the reserve capacity rating of the battery (usually stamped on the case). If not indicated, refer to the manufacturer's specifications for battery capacity.

**NOTE:** *Make battery visual and hydrometer test, then see battery test indications and recommendations (Par. 7).*

## 4. SPECIFIC GRAVITY TEST

A hydrometer is used to test the specific gravity (weight) of the battery electrolyte. The weight of the electrolyte indicates the approximate state of charge of the battery. A temperature corrected hydrometer must be used when testing specific gravity of battery fluid so that the hydrometer reading can be corrected for the effects of the temperature and the true specific gravity determined.

**NOTE:** *If water has been recently added to the cells or the battery fast-charged, the hydrometer reading will be false.*

1. Remove cell caps, being careful to keep dirt out of cells.

2. Draw enough fluid into the hydrometer from one cell to raise the float off the bottom of the tube, but not enough for the float to touch the top of the tube.

3. Hold the hydrometer vertically so that the neck of the float does not touch the sides of the tube, and take the reading at eye-level.

4. Return all the fluid from the hydrometer to the cell being tested and record the reading for that cell.

5. Test the remaining cells in the same manner. Then note the reading on the thermometer on the side of the hydrometer and correct to standard reading at 27° C (80° F) by referring to the table following.

At the top of the table find the column headed by the temperature nearest to the electrolyte temperature; find in that column the figure nearest the observed specific gravity reading and trace horizontally across to the 80° F column. The figure in the 80° F column is the true electrolyte specific gravity and should form the basis for any adjustment.

| -18° C (0° F) | -7° C (20° F) | 4.5° C (40° F) | 27° C (80° F) | 38° C (100° F) | 43° C (110° F) | 50° C (120° F) |
|---|---|---|---|---|---|---|
| 1.251 | 1.243 | 1.236 | 1.220 | 1.213 | 1.209 | 1.205 |
| 1.261 | 1.253 | 1.246 | 1.230 | 1.223 | 1.219 | 1.215 |
| 1.271 | 1.263 | 1.256 | 1.240 | 1.233 | 1.229 | 1.225 |
| 1.281 | 1.273 | 1.266 | 1.250 | 1.243 | 1.239 | 1.235 |
| 1.291 | 1.283 | 1.276 | 1.260 | 1.252 | 1.248 | 1.245 |
| 1.301 | 1.294 | 1.286 | 1.270 | 1.262 | 1.258 | 1.255 |
| 1.312 | 1.304 | 1.296 | 1.280 | 1.272 | 1.268 | 1.265 |

### Test Indications

1.250 to 1.290 specific gravity — Normal state of charge.

1.290 specific gravity or above — Possible overcharging; voltage regulator setting and regulator ground must be tested.

Less than 1.250 specific gravity — Undercharged; entire charging system must be tested.

Specific gravity readings vary .025 or more between cells — Loss of acid of defective cell.

**NOTE:** *Some tractor batteries and "stay-full" type batteries have approximately 20 points lower specific gravity at any given state of charge than standard batteries. Refer to manufacturer's specifications for proper information.*

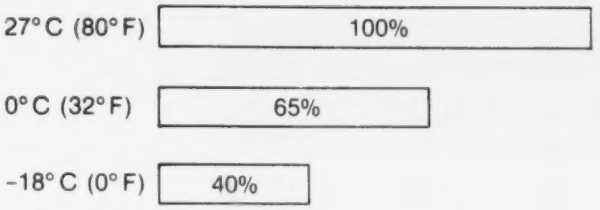
## 5. FREEZING POINTS OF ELECTROLYTE

The electrolyte of a battery will start to freeze (first ice crystals begin to appear in the electrolyte although it does not freeze solid until a lower temperature is reached) approximately as indicated below (specific gravity readings corrected to 80° F):

1.280 sp. gr. ..... Freezes at -68° C (-90° F)
1.250 sp. gr. ..... Freezes at -52° C (-62° F)
1.200 sp. gr. ..... Freezes at -27° C (-16° F)
1.150 sp. gr. ..... Freezes at -15° C (+15° F)
1.100 sp. gr. ..... Freezes at -7° C (+19° F)

### 6. EFFECT OF LOW TEMPERATURES ON A BATTERY PERFORMANCE

Battery capacity is greatly reduced by cold, as cold has a decided numbing effect on the electro-chemical action in the battery. The following comparison indicates the reduction in cranking power of a fully charged battery when the temperature of the electrolyte drops from 27° C (80° F) to 0° C (32° F) and to -18° C (0° F).




### 7. BATTERY TEST INDICATIONS AND RECOMMENDATIONS

| PROBABLE CAUSE | RECOMMENDATIONS |
|---|---|
| SPECIFIC GRAVITY ABOVE 1.290 | The battery is overcharged. See NOTE 2. |
| SPECIFIC GRAVITY BELOW 1.225 | The battery is undercharged. Recharge to full specific gravity. See NOTE 1. |
| LOW TEMPERATURE | Low temperature reduces capacity by retarding chemical reaction. Slow-charge battery until temperature is at least 16° C (60° F), and recheck specific gravity. |
| HARD PLATES | Battery plates become hard (sulphated) if the battery is not maintained above approximately 1.240 specific gravity. Cycle the battery by discharging completely with a lamp load, then recharging at a very slow rate. See NOTE 1. |
| NEW BATTERY | Sometimes a new battery does not reach full capacity until in normal use for 60 to 90 days. If necessary, as in cold weather, the battery can usually be brought quickly to full capacity by cycling. |
| WORN OUT | A battery gradually loses active material from the plates in normal use, and more rapidly if overworked. When too much active material has been lost, the battery cannot be depended upon for cold weather starting or other severe operation even when fully charged and can be considered to be worn out. |
| DEFECTIVE CELLS | A defective cell or cells will result in low capacity and is indicated by wide variation in specific gravity readings between cells. |

**NOTE 1:** *A battery must be maintained at a specific gravity of at least 1.250 to prevent sulphation (hardening) of the battery plates, to assure cold weather starting and normal battery life. Undercharging can be caused by low voltage regulator setting, high charging circuit resistance, high cranking motor amperage draw, faulty alternator or alternator drive belt, excessive use of accessories, etc.*

**NOTE 2:** *Overcharging of a battery can be caused by high voltage regulator setting or the battery being exposed to abnormally high external temperatures. Overcharging is indicated by excessive use of water, extremely high specific gravity and eventually, raised cell covers and warped battery case.*

# STORAGE BATTERIES

## CAUTION WHEN HANDLING BATTERIES

### POISON/DANGER
**CAUSES SEVERE BURNS**

**Contains sulfuric acid. Avoid contact with skin, eyes or clothing. Antidote: EXTERNAL — Flush with water. INTERNAL — Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or veg. oil. Call physician immediately. Eyes: Flush with water for 15 minutes and get prompt medical attention.**

**Batteries produce explosive gases. Keep sparks, flame, cigarettes away. Ventilate when charging or using in enclosed space.**

**Always shield eyes when working near batteries.**

**KEEP OUT OF REACH OF CHILDREN**

Due to a continuous program of research and development, some procedures, specifications and parts may be altered in a constant effort to improve machines.

Periodic revisions may be made to this publication and mailed automatically to distributors. It is recommended that customers contact their distributor or dealer for information on the latest revision.

The black tabs shown on the right-hand side of this page line up with the corresponding tabs in the catalog. Tabs are quickly located by bending the catalog.

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PRINTED IN UNITED STATES OF AMERICA

## TO THE OWNER

IT IS THE POLICY OF INTERNATIONAL HARVESTER COMPANY TO IMPROVE ITS PRODUCTS WHENEVER IT IS POSSIBLE AND PRACTICAL TO DO SO. WE RESERVE THE RIGHT TO MAKE CHANGES OR ADD IMPROVEMENTS AT ANY TIME WITHOUT INCURRING ANY OBLIGATION TO INSTALL SUCH CHANGES ON PRODUCTS PREVIOUSLY SOLD.

When ordering parts, always give the following information.

1. The IH part number including suffix or prefix letters, the name of the part and the quantity needed. Do not include the illustration reference number.
2. The complete chassis and engine serial number of the machine, including the Kind, Variation and Country of Origin codes, and the serial sequence number. (Refer to "INTRODUCTION".)
3. When ordering parts for units which may have their own serial number, such as transmission, torque converter, blade or bucket, drive axle, etc., also include the serial number of such units.

We suggest that you write the serial numbers for your machine in the spaces provided below, for ready reference when parts are needed.

TRACTOR SERIAL NO. _____

POWER UNIT SERIAL NO. _____

REAR AXLE SERIAL NO. _____

FRONT AXLE SERIAL NO. _____

HYDRAULIC PUMP SERIAL NO. _____

HYDRAULIC VALVE SERIAL NO. _____

POWER TAKE-OFF SERIAL NO. _____

TORQUE CONVERTER SERIAL NO. _____

TRANSMISSION SERIAL NO. _____

## CHASSIS SERIAL NUMBERS

| ENGINE MODEL | COUNTRY OF ORIGINs, | STARTING SERIAL NUMBER |
|---|---|---|
| DT-817-B (I.H.) | U.S.A. | 3590307U001002 |
| | CANADA | 3590307C001002 |
| NT-855-C (CUMMINS) | U.S.A. | 3590308U001002 |
| | CANADA | 3590308C001002 |
| DT-817C (I.H.) | U.S.A. Military | 3590307U0* 3590601U0* |
| | CANADA | 3590307C0* |

Usually sequence numbers only are supplied in text. When required, Country of Origin and Engine type (code) will also be shown. Example:

Sequence number - 01234

Country of Origin - U001234

Engine type (code) - 307U001234

The chassis serial number plate is located on the lower left front side of the operator's compartment.

### I.H. ENGINE STARTING SERIAL NUMBER

817-B ENGINE - Refer to EPC-817B Parts Catalog.
817-C ENGINE - Refer to EPC-817C Parts Catalog.

### INSTRUCTIONS FOR ORDERING PARTS

NOTE: Refer frequently to the Alphabetical Index to save time in locating the proper parts.

Parts in this manual are illustrated by the "exploded view" method. Individual parts in each illustration are shown where they belong in relation to one another. Reference numbers only are shown in each illustration. These numbers correspond with numbers in the Reference Number column in the accompanying list of parts. Parts in illustrations without reference numbers are the same as duplicate parts with reference numbers.

CAUTION: Reference numbers should not be used when ordering parts, always use part numbers or description when ordering.

Parts listed herein apply to machines beginning with serial number shown unless otherwise specified in the serial number column or at the top of the page. The quantity required information is shown following the description of the parts. When parts are shown without a quantity it should be understood to mean only (1) is required.

The bucket or blade is always considered as the front end of the machine and right (R.H.) or left hand (L.H.) sides are determined by the operator's position when sitting in the seat facing the front end.

Always give the following information on all repair parts orders.

1. The Part Number, Name and Quantity of Items needed.

2. The Kind, Power, Country of Origin and Unit No. of the machine.

3. When ordering parts for the Transmission, Drive Axle, Pump, Valve or Engine, be sure to give the Serial Number and Model Number of such units.

4. Give the Destination and Method of Shipment desired along with any special invoicing instructions.

*Serial Number Not Available.

# LIST OF ABBREVIATIONS

A period after the abbreviation is used only when the abbreviation form spells a common English word.

| | |
|---|---|
| adj | adjustable |
| al | aluminum |
| aly-stl | alloy steel |
| amp | ampere, amperes |
| anl | annealed |
| approx | approximately |
| assy | assembly |
| att | attachment |
| bd-hd | binding head |
| b-hd | button head |
| brg | bearing |
| brs | brass |
| brz | bronze |
| cd-pltd | cadmium plated |
| cd-pltd-stl | cadmium plated steel |
| cr-pltd | chromium plated |
| cr-pltd-stl | chromium plated steel |
| CI | cast iron |
| csk | countersunk |
| csk-hd | countersunk head |
| cl-rec-hd | clutch recess head |
| com | common |
| cone-pt | cone point |
| contd | continued |
| cop | copper |
| cop-pltd | copper plated |
| cot. | cotter |
| c-pin | cotter pin |
| cres | corrosion-resistant-steel (stainless) |
| cr-rec-hd | cross recess head |
| cre | corrosion resisting |
| crg | carriage |
| cup-pt | cup point |
| cyl | cylinder, cylinders |
| deg | degree |
| dia | diameter |
| dld | drilled |
| dld-f c-pin | drilled for cotter pin |
| dld-f lkg-wire | drilled for locking wire |
| dog-pt | dog point |
| ext | external |
| f | for |
| fem | female |
| fil-hd | fillister head |
| fin-nk | fin neck |
| f-csk-hd | flat countersunk head |
| f-fil-hd | flat fillister head |
| f-hd | flat head |
| f-pt | flat-point |
| flex | flexible |
| fltd | fluted |
| ft | foot (or feet) |
| ga | gauge |
| hd | head |
| hdls | headless |
| hex. | hexagon |
| hex-hd | hexagonal-head |
| hex-soc-hd | hexagon socket head |
| hp | horsepower |
| hv | heavy |
| hyd | hydraulic |
| ID | inside diameter |
| in. | inch or inches |
| int | internal |
| lb | pound, pounds |
| lentil-hd | lentil head |
| LH | left hand |
| lkg | locking |
| LP Gas | Liquefied Petroleum Gas |
| lub | lubrication |
| mach | machine |
| med | medium |
| MI | malleable iron |
| NC | National Coarse Thread |
| NF | National Fine Thread |
| ni | nickel |
| ni-pltd-stl | nickel plated steel |
| No. | number |
| NPT | National pipe thread |
| OC | outside circumference |
| OD | outside diameter |
| O S | oversize |
| ov-hd | oval head |
| oz | ounce |
| parkerized-stl | parkerized steel |
| pkg | package |
| pltd | plated |
| pt | point |
| PTO | power take-off |
| rd-end | round end |
| rd-hd | round head |
| rd-pt | round point |
| reg | regular |
| RH | right hand |
| RPM | revolutions per minute |
| SAE | Society of Automotive Engineers |
| sf | semi-finished |
| slt | slotted |
| slt-hd | slotted head |
| slt-bd-hd | slotted binding head |
| slt-fil-hd | slotted fillister head |
| slt-f-hd | slotted flat head |
| slt-hex-hd | slotted hexagon head |
| slt-pan-hd | slotted pan head |
| slt-rd-hd | slotted round head |
| slt-truss-hd | slotted truss head |
| sq | square |
| sq-hd | square head |
| sq-nk | square neck |
| std | standard |
| std-hd | standard head |
| stl | steel |
| str | straight |
| T | teeth |
| tap. | tapping |
| thd | thread |
| U S | undersize |
| unfin | unfinished |
| wagon-box-hd | wagon box head |
| w | with |
| w brz | with bronze |
| w hex. | with hexagon |
| w o | without |
| zn | zinc |
| zn-ct | zinc coated |
| zn-pltd | zinc plated |

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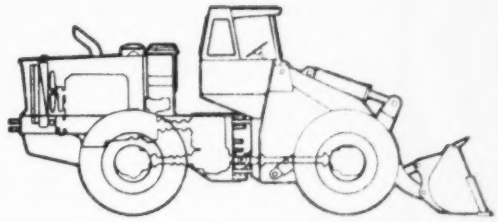
# SECTION 1

# ATTACHMENTS



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| | SEAT SUSPENSION (Air Type) KIT (See Section 13) | |
| | BUCKET TOOTH (See Section 17) | |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## HIGH LIFT BOOM KIT - 13 FOOT

KIT, 13' high lift boom (See NOTE 3)

(Consists of -

| | | |
|---|---|---|
| 1 | BOOM, L.H. | 890 526 C2 |
| 1 | BOOM, R.H. | 890 527 C2 |
| 1 | CYLINDER | 893 165 C93 |
| 1 | LINK | 891 853 C91 |
| 1 | HOSE | 891 854 C91 |
| 1 | HOSE | 891 855 C91 |
| 1 | TUBE | 893 169 C1 |
| 1 | "U" BOLT | 153 676 H1 |
| 1 | VALVE | 875 227 C93 |
| 1 | WASHER | 92 778 R1 |
| 1 | DRAWING, Boom Rework | FGH-11089 |
| 1 | DRAWING, Frame Rework | FGH-11090 |
| 1 | DRAWING, Installation | FGH-11091) |

## HYDRAULIC FRONT END ATTACHMENT KIT

888 762 C91 KIT, hydraulic front end attachment (See NOTES 1 & 2)

(Consists of -

| | | |
|---|---|---|
| 1 | BALL | HL-3343 |
| 2 | BAR | 884 030 C1 |
| 8 | BOLT | 179 841 |
| 2 | BOLT | 181 326 |
| 16 | BOLT | 179 860 |
| 2 | BOSS | 884 038 C1 |
| 4 | BUSHING | 144 243 H1 |
| 8 | CLAMP | 183 692 H1 |
| 1 | CLEVIS | 177 219 H1 |
| 2 | COLLAR | 133 344 H1 |
| 1 | FITTING | 109 454 |
| 8 | FLANGE | 128 542 H1 |
| 4 | FLANGE | 877 949 C1 |
| 1 | HOSE | 888 764 C1 |
| 1 | HOSE | 888 765 C1 |
| 2 | FLAT WASHER | 106 263 |
| 1 | LEVER | 888 766 C91 |
| 1 | LEVER | 888 768 C91 |
| 2 | LOCK WASHER | 103 319 |
| 14 | NUT | 18 423 R1 |
| 2 | NUT | 103 024 |
| 2 | NUT | 166 897 H1 |
| 4 | "O" RING | 293 739 R1 |
| 2 | "O" RING | 876 071 C1 |
| 8 | "O" RING | 876 072 C1 |
| 1 | "O" RING | 876 074 C1 |
| 1 | "O" RING | 876 075 C1 |
| 2 | "O" RING | 876 110 C1 |
| 4 | PIN | 114 787 |
| 2 | PIN | 888 771 C1 |
| 4 | PLATE | 183 693 H1 |
| 2 | PLATE | 888 763 C1 |
| 1 | ROD | 884 062 C1 |
| 8 | STUDS | 183 649 H1 |
| 4 | STUDS | 204 273 H1 |
| 2 | SWIVEL | 9 410 207 |
| 1 | TUBE | 888 773 C2 |
| 1 | TUBE | 888 774 C2 |
| 1 | TUBE | 888 775 C1 |
| 1 | TUBE | 888 776 C2 |

NOTE 1: Order on Machine Order Form.

NOTE 2: All parts are listed and illustrated throughout this catalog.

NOTE 3: Kit No Longer Available. Service Parts Only Will Be Furnished.



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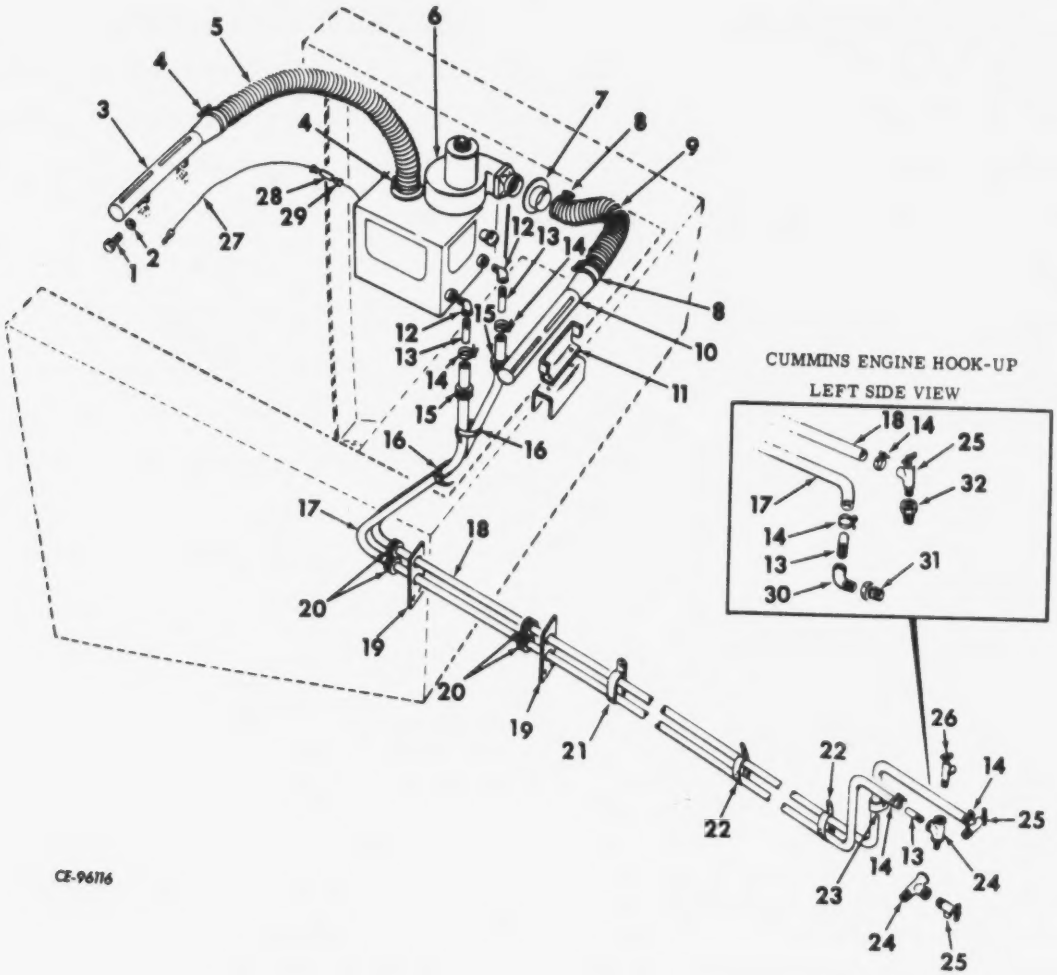
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

HEATER & DEFROSTER KIT (Not used on units equipped with Roll-Over-Protective Structure)




Parts without letters after the description indicates the part is used for all Heater and Defroster Kits. Letters A & B are used to identify Separate Kits.

| | | |
|---|---|---|
| A | 890 837 C91 | KIT, heater and defroster (I.H. Engine) (See Note 1) |
| B | 893 407 C91 | KIT, heater and defroster (Cummins Engine) (See Note 1) |

**FRONT DEFROSTER LINES**

| | | |
|---|---|---|
| 1 | 181 309 | BOLT, 1/4NF x 5/8" (2) |
| 2 | 103 319 | WASHER, 1/4" lock (2) |
| 3 | 886 265 C1 | TUBE, diffuser |
| 4 | 279 027 R91 | CLAMP (2) |
| 5 | 197 599 H1 | HOSE |
| 6 | | HEATER (See Heater in this Section) |
| | 103 025 | NUT, 5/16NF hex (4) |
| | 103 320 | WASHER, 5/16 lock (4) |

NOTE 1: Order on Machine Order Form.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**HEATER & DEFROSTER KIT - Continued**
**(Not used on units equipped with Roll-Over Protective Structure)**

**REAR DEFROSTER LINES**

| | | |
|---|---|---|
| 7 | 200 112 H1 | ADAPTER |
| 8 | 279 027 R91 | CLAMP (2) |
| 9 | 187 493 H1 | TUBE |
| 10 | 890 277 C1 | TUBE, diffuser rear |
| 11 | 890 332 C1 | BRACKET |
| | 181 311 | BOLT, 1/4NF x 5/8" (2) |
| | 103 024 | NUT, 1/4NF hex (2) |
| | 103 319 | WASHER, 1/4" lock (2) |
| | 181 365 | BOLT, 3/8NF x 1-1/8" (2) |
| | 214 441 | NUT, 3/8 - 24 hex (2) |
| | 103 321 | WASHER, 3/8" lock (2) |

**HOT WATER FEEDER & RETURN LINE**

| | | |
|---|---|---|
| 12 | 120 063 | ELBOW (2) |
| 13 | 123 700 H1 | NIPPLE (3) |
| 14 | 274 085 R91 | CLAMP (4) |
| 15 | 127 440 H1 | GROMMET (2) |
| 16 | 610 213 C91 | STRAP (two used on KIT B) |
| 17 | | HOSE, return (Cut length 5/8" I.D. x 195" long) (Cut from bulk hose 364 359 C1) |
| 18 | | HOSE, supply (Cut length 5/8" I.D. x 205" long) (Cut from bulk hose 364 359 C1) |
| 19 | 215 231 H1 | SUPPORT (2) |
| | 181 339 | BOLT, 5/16NF x 1" (4) |
| | 103 320 | WASHER, 5/16" lock (4) |
| | 103 025 | NUT, 5/16" hex (4) |
| 20 | 201 874 H1 | GROMMET (4) |
| 21 | 201 875 H1 | CLAMP |
| 22 | 610 213 C91 | STRAP (two used on KIT A) |
| 23 | HL-3551 | CLAMP |
| 24 | 444 258 | TEE (KIT A) (2) |
| 25 | 301 803 R91 | SHUT-OFF COCK |
| 26 | | DRAIN COCK (Furnished with Engine) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**HOT WATER FEEDER & RETURN LINE - Con't.**

| | | |
|---|---|---|
| 27 | 215 289 H1 | WIRE, male connector to heater |
| 28 | 113 868 H1 | CONNECTOR |
| 29 | 46 894 H | TERMINAL |
| 30 | 120 702 | ELBOW (KIT B) |
| 31 | 144 048 | ADAPTER (KIT B) |
| 32 | 144 046 | ADAPTER (KIT B) |
| | FGH-11398 | DRAWING, heater and defroster |
| | FGH-11699 | DRAWING, heater lines |
| | 364 359 C1 | HOSE, bulk 5/8"ID x 50 ft. (#) (x) |

(#) - Part number and price covers one foot of bulk item.

(x) - As Required.



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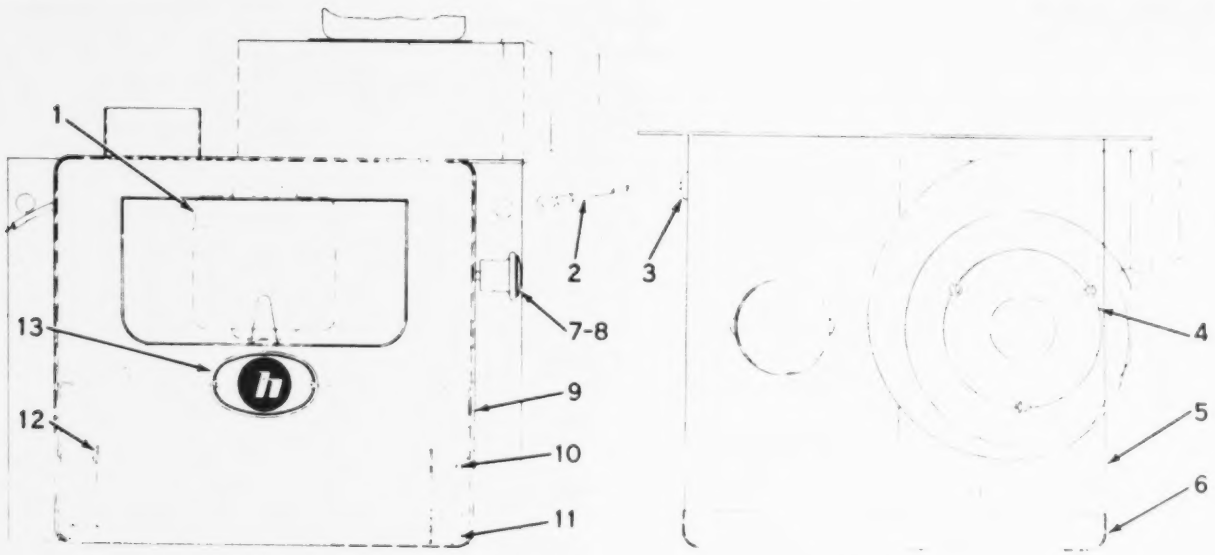
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**HEATER (Not used on units equipped with Roll-Over Protective Structure)**




FRONT VIEW

TOP VIEW

CE-91884

Parts without letters after the description indicates the part is used for all heaters. Letters A & B are used to identify separate heaters.

| | | |
|---|---|---|
| A | 181 763 H1 | HEATER (HV-210 527) (Order Heater, 181 763 H2) |
| B | 181 763 H2 | HEATER (HV-212 219) |
| 1 | 190 356 H1 | MOTOR (Heater A) |
| 1 | 934 540 C91 | MOTOR (Heater B) |
| 2 | | WIRE, lead (Not furnished separately) |
| 3 | | GROMMET (Not furnished separately) |
| 4 | | COVER (Not furnished separately) |
| 5 | | BOX (Not furnished separately) |
| 6 | | COVER, front (Not furnished separately) |
| 7 | | WIRE (Not furnished separately) |
| 8 | 305 722 C91 | SWITCH |
| 9 | | PLATE, data (Not furnished separately) |
| 10 | | TAPE, felt (Not furnished separately) |
| 11 | | RUBBER (Not furnished separately) |
| 12 | 202 620 H1 | CORE (Heater A) |
| 12 | 933 069 C1 | CORE (Heater B) |
| 13 | | PLATE, name (Not furnished separately) |
| | 196 333 H1 | FAN |

**REAR VIEW MIRROR KIT**

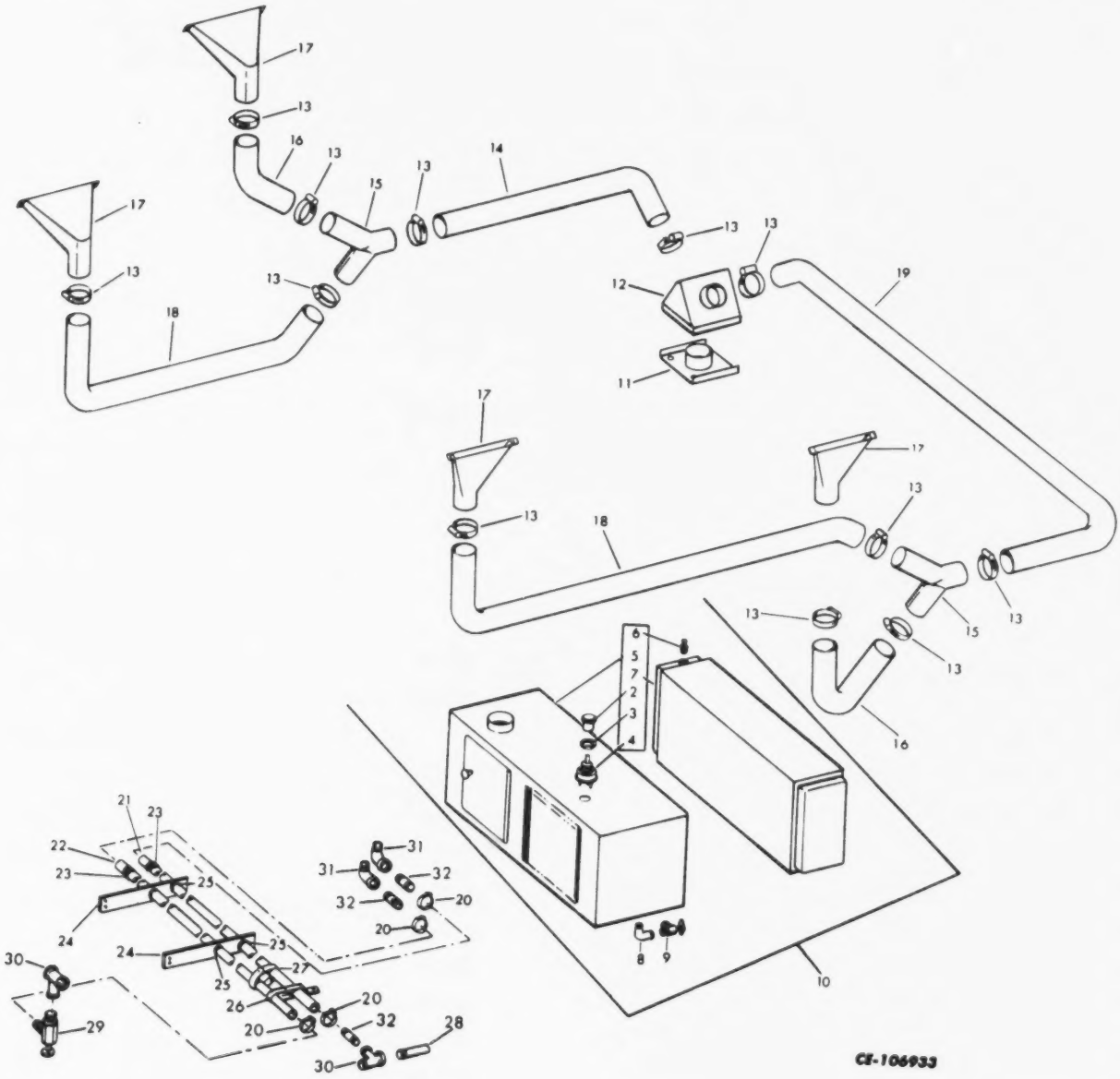
| | |
|---|---|
| 891 161 C91 | KIT, rear view mirror (See Note 1) (Consists of the following) |
| 181 313 | BOLT, 1/4NF x 3/4 (8) |
| 244 691 R91 | MIRROR (2) |
| 880 858 C91 | MIRROR ARM KIT (2) |
| 103 024 | NUT, 1/4NF (8) |
| 103 319 | WASHER, 1/4" lock (8) |
| FGH-11429 | DRAWING, cab |

NOTE 1: Order on Machine Order Form.

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

**HEATER & DEFROSTER PIPING (Used only on units Equipped with Roll-Over-Protective Structure)**

U001899 and below
C001897 and below



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**HEATER AND DEFROSTER PIPING (Used only on units Equipped with Roll-Over Protective Structure) - Continued**
**U001899 and below**
**C001897 and below**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 875 752 C91 | HEATER ASSEMBLY |
| 2 | 881 180 C1 | KNOB |
| 3 | 109 311 H1 | NUT, 7/8-28 (2) |
| 4 | 881 179 C1 | SWITCH |
| 5 | | HOUSING, heater (Not furnished separately) |
| | 109 084 | NUT, 1/4 - 20 NC (6) |
| | 103 319 | WASHER, 1/4" lock (4) |
| 6 | 881 228 C1 | VALVE, bleeder |
| 7 | 881 227 C1 | CORE, heater |
| 8 | 103 488 H1 | ELBOW, 90° |
| 9 | 301 803 R91 | VALVE, water |
| 10 | 875 745 C93 | PACKAGE, heater |
| 11 | 928 923 C1 | BRACKET, heater to defroster outlet |
| | 23 985 R1 | SCREW, self tapping (3) |
| 12 | 270 609 C91 | OUTLET, defroster lines to heater |
| 13 | 279 027 R91 | CLAMP (12) * and below |
| 13 | 279 027 R91 | CLAMP (4) * and up |
| 14 | 927 553 C2 | HOSE, heater to front tee * and below |
| 14 | | HOSE, heater to front tee (Cut length 2"ID x 21" long) (Cut from bulk HOSE, 997 042 R1) * thru * |
| 15 | 928 457 C1 | TEE (2) * and below |
| 16 | 928 989 C2 | HOSE (2) * and below |
| 17 | 927 516 C1 | VENT, defroster (4) |
| | 132 833 | SCREW (8) |
| | 19 910 R1 | NUT (8) * and below |
| 18 | 928 991 C1 | HOSE (2) * and below |
| 19 | 928 990 C2 | HOSE, heater to rear defroster * and below |
| 19 | | HOSE, heater to rear defroster (Cut length 2" ID x 54" long) (Cut from bulk HOSE, 997 042 R1) * and up |
| 20 | 274 085 R91 | CLAMP, hose (2) |
| 21 | | HOSE, head to heater (cut length 5/8" I.D. x 225" long) (Cut from bulk hose, 364 359 C1) |
| 22 | | HOSE, heater to engine (cut length 5/8" I.D. x 235" long) (Cut from bulk hose, 364 359 C1) |
| 23 | 81 986 R1 | GROMMET (2) |
| 24 | 215 231 H1 | BRACKET (2) |
| | 181 339 | BOLT (4) |
| | 103 025 | NUT (4) |
| | 103 320 | WASHER, lock (4) |
| 25 | 201 874 H1 | GROMMET (2) |
| 26 | 218 859 H1 | CLAMP |
| 27 | 610 213 C91 | STRAP (7) |
| 28 | | DRAIN COCK (Refer to EPC-817B engine Manual) |
| 29 | 301 803 R91 | COCK, shut off (2) |
| 30 | 444 258 | TEE (2) |
| 31 | 120 063 | ELBOW, 90° (2) |
| 32 | 123 700 H1 | NIPPLE (3) |
| | 364 359 C1 | HOSE, bulk (5/8" x 50 ft.) (*) (x) |
| | 997 042 R1 | HOSE, bulk (2" x 6 ft.) (#) (x) |

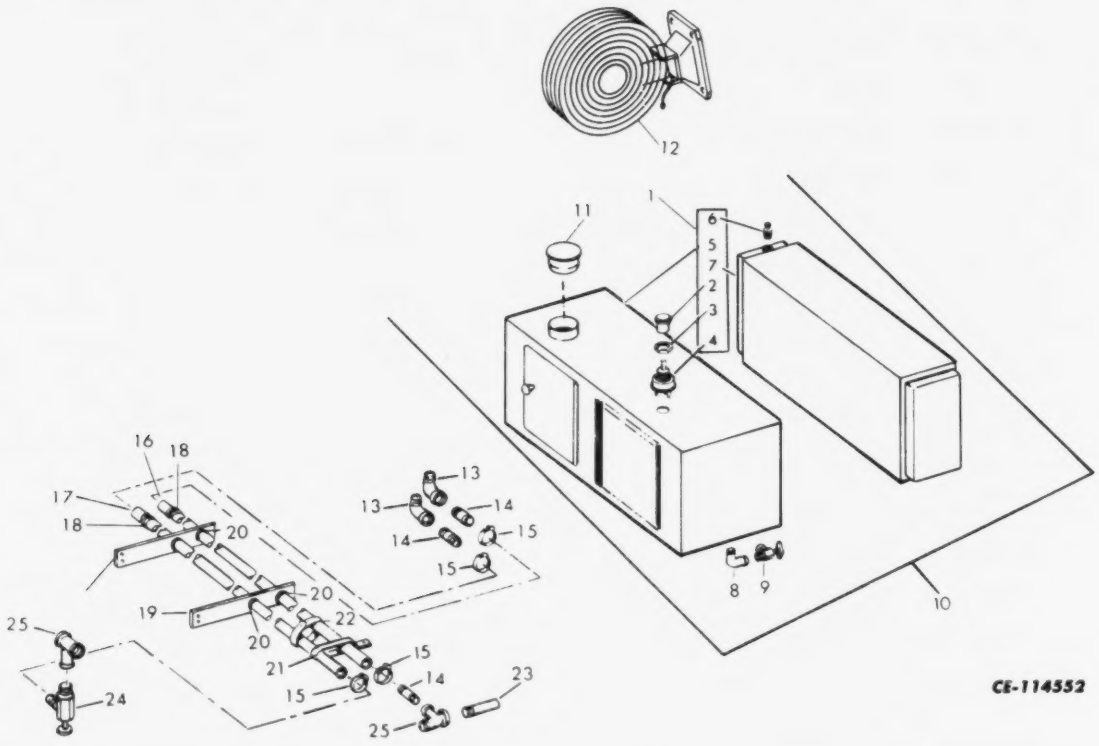
(*) - Serial Number Not Available.

(*) - Part number and price covers one foot of bulk item.

(x) - As Required.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

HEATER AND DEFROSTER PIPING (Used only on Units Equipped with Roll-Over Protective Structure)
U001900 and up
C001878 and up




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 875 752 C91 | HEATER ASSEMBLY |
| 2 | 881 180 C1 | KNOB |
| 3 | 109 311 H1 | NUT, 7/8-28 (2) |
| 4 | 881 179 C1 | SWITCH |
| 5 | | HOUSING, heater (Not furnished separately) |
| | 109 084 | NUT (6) |
| | 103 319 | WASHER, lock (4) |
| 6 | 881 228 C1 | VALVE, bleeder |
| 7 | 881 227 C1 | CORE, heater |
| 8 | 103 488 H1 | ELBOW, 90° |
| 9 | 301 803 R91 | VALVE, water |
| 10 | 875 745 C93 | PACKAGE, heater |
| 11 | 875 961 C1 | CAP, plug |
| 12 | 1 107 879 C1 | FAN, defroster |
| | 186 742 | BOLT (4) |
| | 110 633 | NUT (4) |
| | 106 497 | WASHER (4) |
| 13 | 120 063 | ELBOW, 90° (2) |
| 14 | 123 700 H1 | NIPPLE (3) |
| 15 | 274 085 R91 | CLAMP, hose (4) |
| 16 | | HOSE, head to heater (Cut length 5/8"ID x 225" long) (Cut from bulk HOSE, 364 359 C1) |
| 17 | | HOSE, heater to engine (Cut length 5/8"ID x 235" long) (Cut from bulk HOSE, 364 359 C1) |
| 18 | 81 986 R1 | GROMMET (2) |
| 19 | 215 231 H1 | BRACKET (2) |
| | 181 339 | BOLT (4) |
| | 103 025 | NUT (4) |
| | 103 320 | WASHER, lock (4) |
| 20 | 201 874 H1 | GROMMET (4) |
| 21 | 218 859 H1 | CLAMP |
| 22 | 610 213 C91 | STRAP (7) |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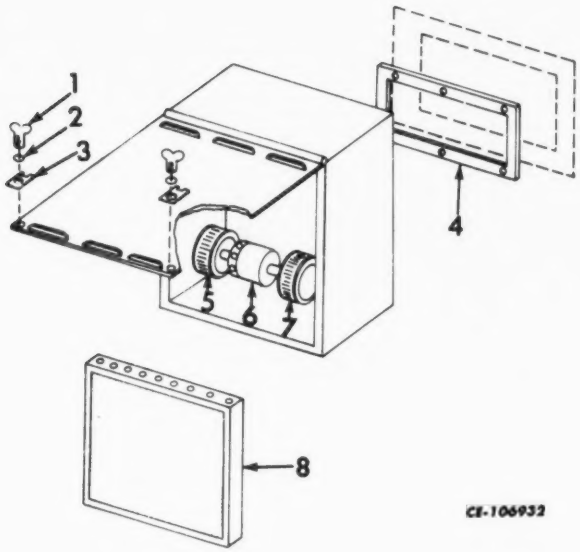
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **HEATER AND DEFROSTER PIPING (Used only on Units Equipped with Roll-Over Protective Structure) - Continued** |
| | | **U001900 and up** |
| | | **C001897 and up** |
| 23 | | DRAIN COCK (Refer to EPC-817B or 817C Engine Manual) |
| 24 | 301 803 R91 | COCK, shut-off (2) |
| 25 | 444 258 | TEE (2) |
| | 931 256 C1 | CLIP, wiring (4) |
| | 167 713 H1 | GROMMET |
| | 364 359 C1 | HOSE, bulk (5/8" x 50 ft.) (x) |

(x) - As Required.

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

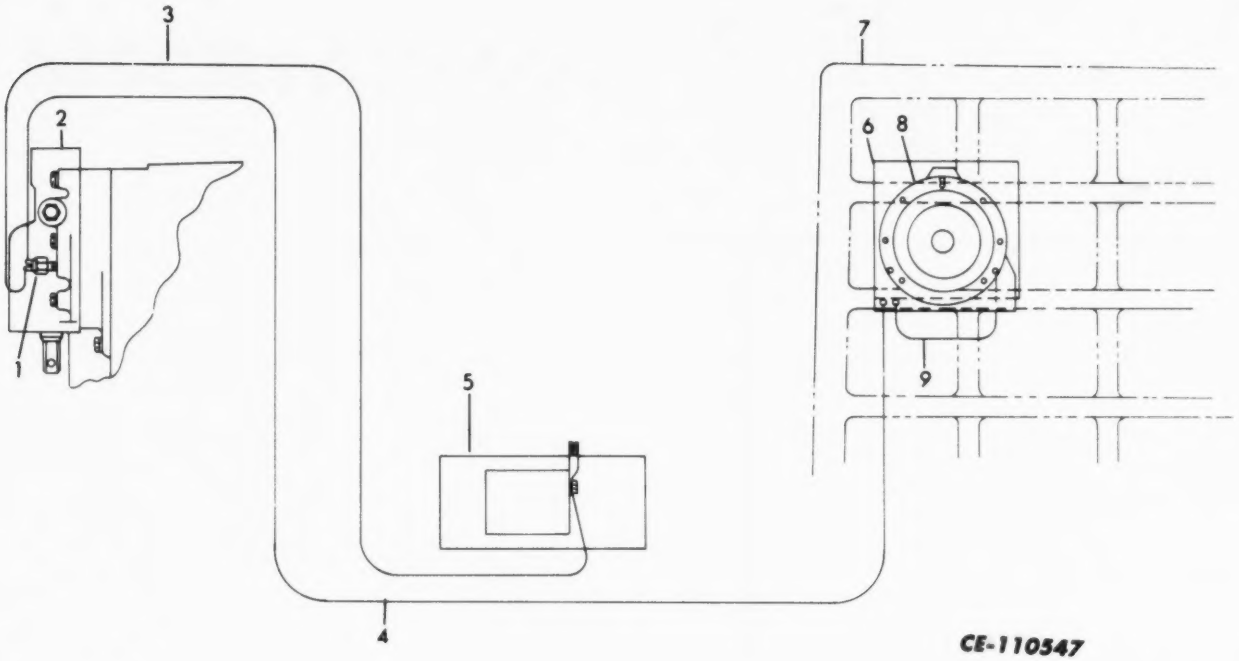
**BLOWER (Used only on units equipped with Roll-Over Protective Structure Heater)**




| | | |
|---|---|---|
| | 875 744 C91 | PACKAGE, blower<br>(Consists of all the following - |
| | 102 634 | NUT (8) |
| | 103 320 | WASHER, lock (8) |
| 1 | 881 231 C1 | STUD, wing head (2) |
| 2 | 401 936 C1 | RING, retainer (2) |
| 3 | 402 405 R1 | RECEPTACLE, stud mounting (2) |
| 4 | 875 749 C1 | GASKET, blower to bulkhead |
| 5 | 881 233 C1 | WHEEL, blower (clockwise) |
| 6 | 875 707 C91 | MOTOR, 24 volts |
| 7 | 881 234 C1 | WHEEL, blower (counterclockwise) |
| 8 | 881 229 C1 | FILTER |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

BACK-UP ALARM KIT

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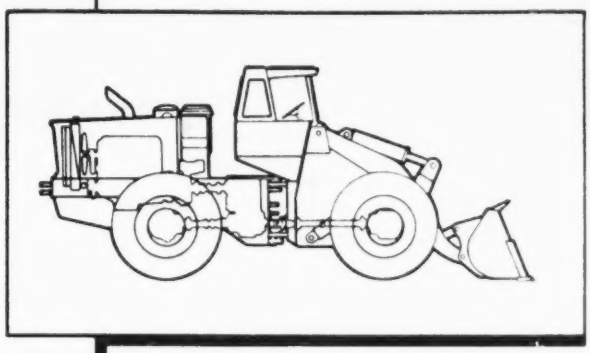
| | | |
|---|---|---|
| | 937 739 C91 | KIT, back-up alarm (See Note 1) (Consists of the following parts, except reference numbers 2, 5 and 7. |
| 1 | 885 441 C2 | SWITCH, pressure |
| 2 | | TRANSMISSION (Refer to Transmission) |
| 3 | 933 072 C1 | CABLE, pressure switch to starter solenoid |
| 4 | 933 073 C1 | CABLE, pressure switch to alarm |
| 5 | | STARTER (Refer to Engine Manual EPC-817C) |
| 6 | 936 659 C1 | BAR, alarm mounting |
| 7 | | GRILLE (Refer to Grille) |
| 8 | 663 478 C1 | ALARM, back-up |
| | 26 290 R1 | BOLT, hose-hd cap (3) |
| | 25 519 R1 | NUT (3) |
| | 25 542 R1 | WASHER, flat (6) |
| 9 | 202 075 H1 | WIRE, ground |
| | FGH-148 45 | DRAWING, installation back-up alarm |

NOTE 1 - Order on Machine Order Form.

SECTION 2

# MISCELLANEOUS



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| TOOL SET | |
| 18 Piece | 25 |
| 44 Piece | 26 |
| 13 Piece | 28 |


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# QUICK REFERENCE
# FOR
# FILTER ELEMENTS AND BELTS

| ELEMENTS | I.H. ENGINE | CUMMINS ENGINE |
|---|---|---|
| **LUBRICATING SYSTEM** | | |
| Engine Lubricating Oil Filter Element w/Gasket | * | # |
| By-Pass Oil Filter Element | | # |
| **FUEL SYSTEM** | | |
| Final Fuel Filter | * | # |
| Primary Fuel Filter Element | * | # |
| **TORQUE CONVERTER AND TRANSMISSION** | | |
| Transmission and Torque Converter Lines Hydraulic Oil Filter Element<br>U001179 and below<br>C001228 and below | 302 574 R91 | 302 574 R91 |
| Transmission and Torque Converter Lines Hydraulic Oil Filter Element<br>U001180 and up<br>C001229 and up | 896 811 C1 | 896 811 C1 |
| Transmission Oil Filter Element | 220 845 H1 | 220 845 H1 |
| **HYDRAULIC SYSTEM** | | |
| Hydraulic Reservoir Filter Element | 877 826 C4 | 877 826 C4 |
| **AIR CLEANER** | | |
| Air Cleaner Filter Element<br>U001290 and below<br>C001287 and below | 304 766 C92 | 304 766 C92 |
| Air Cleaner Filter Element<br>Primary Element<br>Safety Element<br>U001291 and up<br>C001288 and up | 702 672 C1<br>702 673 C1 | 702 672 C1<br>702 673 C1 |
| **BELTS** | | |
| Air Compressor Belt | | # |
| Alternator Belt | | # |

# See Cummins Engine Manual and special modification parts list form no. CUM-4.

* See EPC-817B or 817C Parts Catalog.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **SERVICE PACKAGES** |
| | 195 558 H2 | KIT, oil seal (Transmission) |
| | | (Consists of - |
| | | 1 OIL SEAL 134 045 H1 |
| | | 1 OIL SEAL 148 574 H1 |
| | | 1 OIL SEAL 156 348 H1 |
| | | 2 OIL SEAL 194 292 H1 |
| | | 2 OIL SEAL 333 996 R92 |
| | | 1 OIL SEAL 615 851 C1 ) |
| | 195 559 H2 | KIT, gasket (Transmission) |
| | | (Consists of - |
| | | 5 GASKET 321 992 R1 |
| | | 1 GASKET 148 833 H1 |
| | | 1 GASKET 148 835 H2 |
| | | 1 GASKET 148 890 H1 |
| | | 1 GASKET 149 224 H1 |
| | | 2 GASKET 149 421 H1 |
| | | 1 GASKET 156 257 H1 |
| | | 1 GASKET 927 534 C1 |
| | | 1 GASKET 156 329 H1 |
| | | 2 GASKET 156 330 H1 |
| | | 2 GASKET 156 350 H1 |
| | | 1 GASKET 156 352 H1 |
| | | 1 GASKET 156 367 H1 |
| | | 1 GASKET 156 398 H1 |
| | | 1 GASKET 156 398 H1 |
| | | 2 GASKET 169 206 H1 |
| | | 2 GASKET 194 294 H1) |
| | 894 682 C91 | KIT, shim, seal and gasket (Torque Converter) |
| | | (Consists of - |
| | | 1 GASKET 1 101 592 C1 |
| | | 2 GASKET 199 275 H1 |
| | | 1 LOCK PLATE 610 256 C1 |
| | | 1 NUT 19 263 R1 |
| | | 1 PLATE LOCKING 324 071 R2 |
| | | 1 SEAL 333 996 R92 |
| | | 2 SEAL 199 294 H1 |
| | | 2 SEAL "O" RING 22 414 R1 |
| | | 2 SEAL "O" RING 393 120 R1 |
| | | 1 SEAL RING 156 283 H1 |
| | | 1 SEAL RING 210 858 H1 |
| | | 3 SHIM 199 348 H2 |
| | | 2 SHIM 199 351 H2 |
| | | 2 SHIM 199 352 H2 |
| | | 3 SHIM 210 845 H1 |
| | | 2 SHIM 347 089 R1 |
| | | 2 SHIM 347 090 R1 |
| | | 1 SHIM 625 858 C1) |
| | 875 492 C92 | KIT, seal and "O" ring (Used on Transmission P-2004) |
| | | (Consists of - |
| | | 1 "O" RING 22 285 R1 |
| | | 1 "O" RING 22 417 R1 |
| | | 2 "O" RING 157 255 H1 |
| | | 4 "O" RING 254 954 R1 |
| | 875 492 C92 | KIT, seal and "O" ring (Used on Transmission P-2004) |
| | | (Consists of - Continued |
| | | 1 "O" RING 347 641 R1 |
| | | 1 "O" RING 350 684 R1 |
| | | 4 "O" RING 352 221 R1 |
| | | 2 "O" RING 610 418 C1 |
| | | 12 SEAL 878 116 C1) |
| | | **NAME AND INSTRUCTION PLATES** |
| | 178 492 H1 | PLATE, parking brake light |
| | 150 600 H1 | DRIVE RIVET (2) |
| | 213 878 H1 | PLATE, name, forward and reverse |
| | 214 122 H1 | PLATE, name, 1st, 2nd, 3rd, and 4th |
| | 105 898 H1 | SCREW (8) |
| | 312 552 R1 | PLATE, turbocharger warning (I.H.) |
| | 887 515 C1 | PLATE, serial number |
| | 215 112 H1 | WASHER (4) |
| | 928 420 C1 | PLATE, roll-over protective structure serial number |
| | 928 427 C1 | RIVET, drive (2) |
| | | **PRODUCT GRAPHICS** |
| | | Parts without letters after the description indicates this part is used for all Decal Kits listed below; Letters A and B are used to identify separate Decal Kits. |
| A | 893 805 C94 | KIT, decal (I.H.) |
| B | 893 806 C93 | KIT, decal (Cummins) |
| | | DECAL, air reservoir drain (Not furnished separately) |
| | | DECAL, alternator warning (Not furnished separately) |
| | | DECAL, caution clearance (Not furnished separately) (2) |
| | | DECAL, caution hinge pin nut (Not furnished separately) (2) |
| | | DECAL, cold weather start decal, cooling system caution |
| | | DECAL, converter oil temperature (Not furnished separately) |
| | | DECAL, Diesel fuel (Not furnished separately) |
| | | DECAL, hydraulic reservoir (Not furnished separately) |
| | | DECAL, I.H. (Not furnished separately (2) |
| | | DECAL, model symbol (Not furnished separately) (2) |
| | | DECAL, model symbol (Not furnished separately) (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

PRODUCT GRAPHICS - Continued

DECAL, off (Not furnished separately)
DECAL, oil pressure warning (Not furnished separately)
DECAL, on (Not furnished separately)
DECAL, operator safety caution
DECAL, payloader (Not furnished separately)
DECAL, payloader (Not furnished separately)
DECAL, safety instructions (Not furnished separately)
DECAL, starter (Not furnished separately)
DECAL, transmission fluid (Not furnished separately)
DECAL, valve lash & injection setting (Not furnished separately) (Kit A) (2)
DECAL, warning (Not furnished separately)
DECAL, radiator (Not furnished separately)
DECAL, reservoir instruction

SPECIAL TOOLS

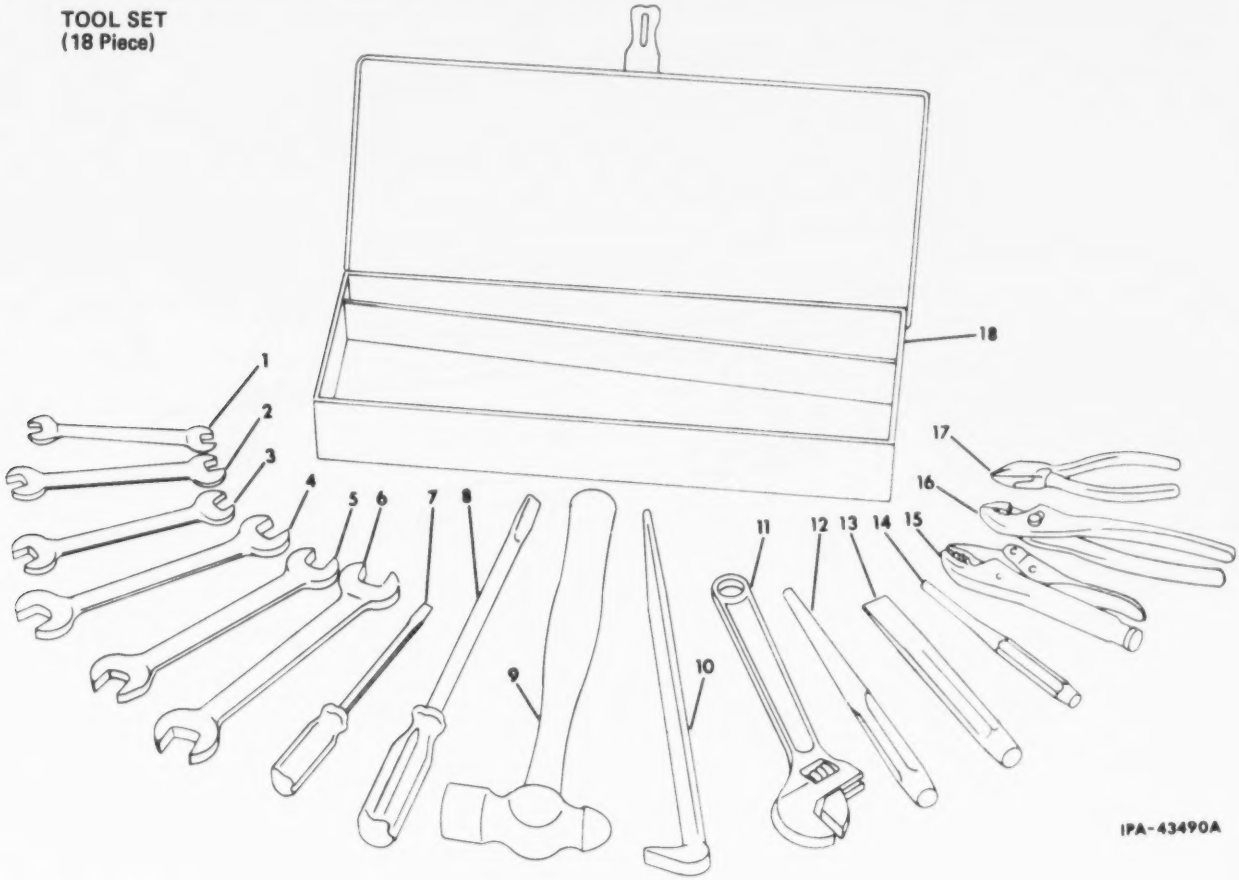
| | |
|---|---|
| 883 514 C91 | LUBRICATOR w/Grease Gun, 143 950 H1 and nozzle, 143 951 H1 |
| 143 950 H1 | GUN, grease |
| 143 951 H1 | NOZZLE |
| 143 952 H1 | CLAMP, grease gun |
| 217 999 H1 | HOSE, tire inflation |
| 103 537 H1 | HANDLE, wheel nut wrench |
| 161 902 H1 | EXTENSION, handle |
| 103 536 H1 | WRENCH, wheel nut |

TOOL BOX
(Used on H-100C Military)

| | |
|---|---|
| 325 479 R91 | BOX, tool |
| 24 841 R1 | BOLT (4) |
| 25 522 R1 | NUT (4) |
| 137 344 H1 | SPACER (4) |
| 25 544 R1 | WASHER (8) |
| 650 382 C91 | PADLOCK w/KEY |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

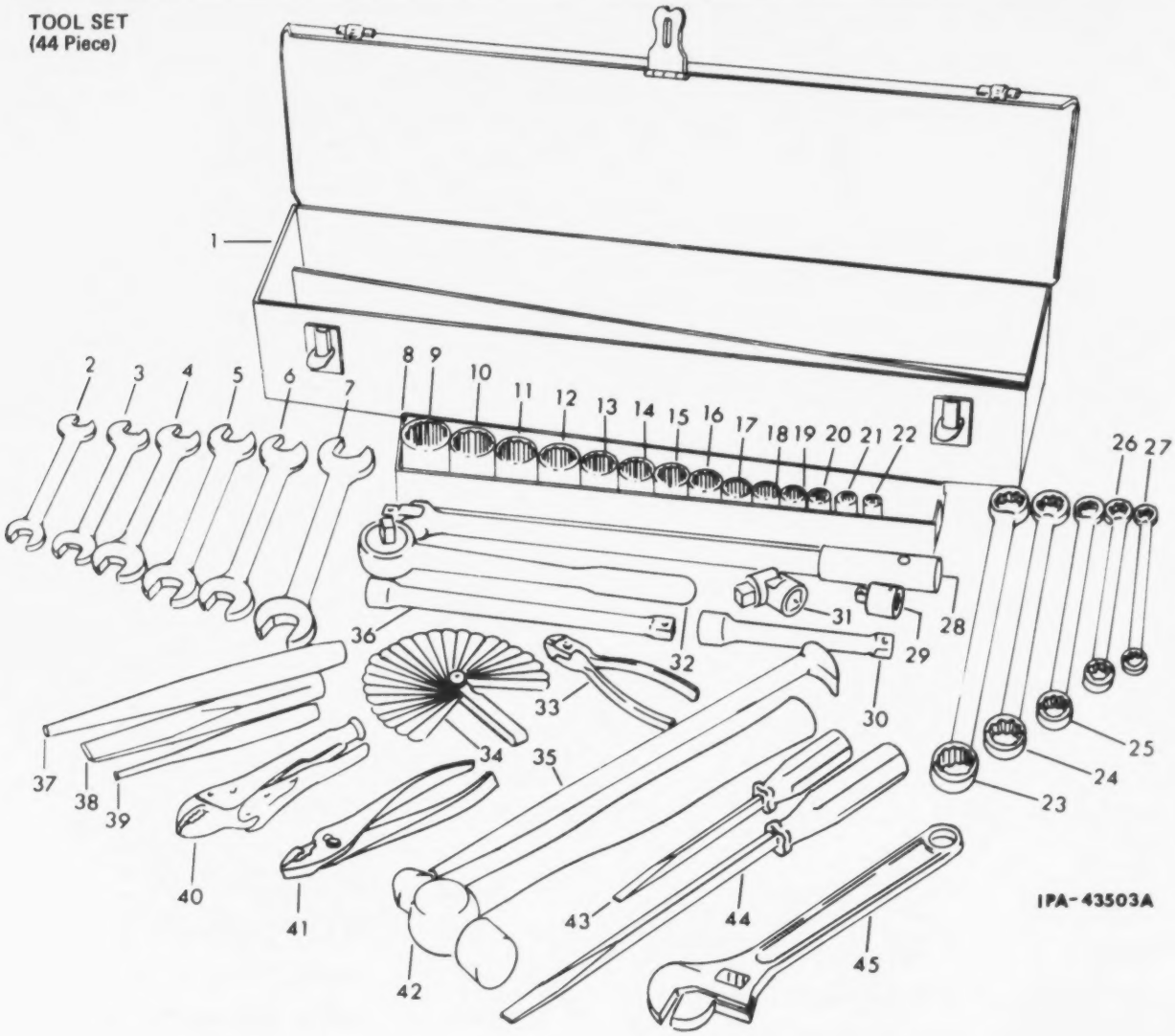
TOOL SET
(18 Piece)




| | | |
|---|---|---|
| | | TOOL SET (Consists of seventeen tools and tool box) (Also see "Special Tools" in this Section) (See NOTE) (IH Part Number 276 820 R91) |
| 1 | E-1416 | WRENCH, end (7/16 x 1/2") |
| 2 | E-1820 | WRENCH, end (9/16 x 5/8") |
| 3 | E-2022 | WRENCH, end (5/8 x 11/16") |
| 4 | E-2426 | WRENCH, end (3/4 x 13/16") |
| 5 | E-2628 | WRENCH, end (13/16 x 7/8") |
| 6 | E-3032 | WRENCH, end (15/16 x 1") |
| 7 | SS-83 | SCREWDRIVER (1/4" shank) |
| 8 | SS-123 | SCREWDRIVER (3/8" shank) |
| 9 | BP-32 | HAMMER (ball peen) |
| 10 | PB-32 | BAR, pry (9/16" rd. x 16" long) |
| 11 | DA-12 | WRENCH, 12" adjustable |
| 12 | TP-24 | PUNCH (5/16" bit x 10" long) |
| 13 | CC-24 | CHISEL (7/8" bit x 8" long) |
| 14 | PP-6 | PUNCH (3/16" bit x 10" long) |
| 15 | 719 | WRENCH, vise grip (7") |
| 16 | 712-A | PLIER (slip joint, 8") |
| 17 | 700-B | CUTTER, diagonal (6") |
| 18 | H-190 | BOX, tool |

NOTE: Order individual tools and complete tool set from International Harvester Company, Parts & Service Development Department, 600 Woodfield, Schaumburg, Illinois, 60196.

TOOL SET
(44 Piece)

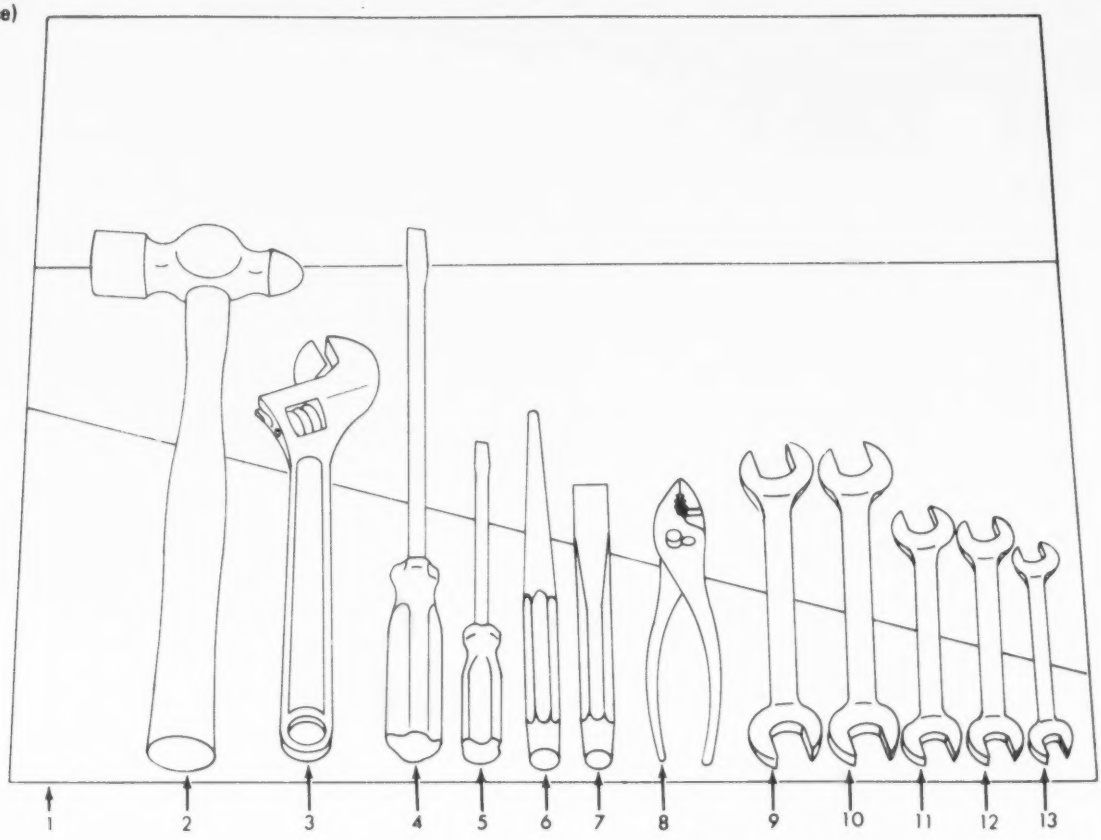



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | TOOL SET (Consists of forty three tools and tool box) (Also see "Special Tools" in this Section) (IH Part Number 276 821 R91) (See Note) |
| 1 | H-391 | BOX, tool |
| 2 | E-1416 | WRENCH, end (7/16 x 1/2") |
| 3 | E-1820 | WRENCH, end (9/16 x 5/8") |
| 4 | E-2022 | WRENCH, end (5/8 x 11/16") |
| 5 | E-2426 | WRENCH, end (3/4 x 13/16") |
| 6 | E-2628 | WRENCH, end (13/16 x 7/8") |
| 7 | E-3032 | WRENCH, end (15/16 x 1") |
| 8 | 195 | TRAY |
| 9 | 140 | SOCKET (1-1/4") |
| 10 | 138 | SOCKET (1-3/16") |
| 11 | 136 | SOCKET (1-1/8") |
| 12 | 134 | SOCKET (1-1/16") |
| 13 | 132 | SOCKET (1") |
| 14 | 130 | SOCKET (15/16") |
| 15 | 128 | SOCKET (7/8") |
| 16 | 126 | SOCKET (13/16") |
| 17 | 124 | SOCKET (3/4") |
| 18 | 122 | SOCKET (11/16") |
| 19 | 120 | SOCKET (5/8") |
| 20 | 118 | SOCKET (9/16") |
| 21 | 116 | SOCKET (1/2") |
| 22 | 114 | SOCKET (7/16") |

NOTE: Order individual tools and complete tool set from International Harvester Company, Parts & Service Development Department, 600 Woodfield, Schaumburg, Illinois, 60196.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TOOL SET - Continued (44 Piece)** |
| 23 | B-3032 | WRENCH, box (15/16 x 1") |
| 24 | B-2628 | WRENCH, box (13/16 x 3/4") |
| 25 | B-2024 | WRENCH, box (5/8 x 3/4") |
| 26 | B-1820 | WRENCH, box (9/16 x 5/8") |
| 27 | B-1416 | WRENCH, box (7/16 x 1/2") |
| 28 | H-177 | HANDLE, flex |
| 29 | D-1612 | ADAPTER (1/2" female, 3/8" male) |
| 30 | H-172 | EXTENSION (6") |
| 31 | H-189 | JOINT, universal |
| 32 | H-163 | RATCHET, (Reversible) |
| 33 | 700-B | CUTTER, diagonal (6") |
| 34 | 861 | GAUGE, feeler (25 blades) |
| 35 | PB-43 | BAR, pry (9/16" rd. x 16" long) |
| 36 | H-173 | EXTENSION (10") |
| 37 | TP-24 | PUNCH (5/16" bit x 10" long) |
| 38 | CC-24 | CHISEL (7/8" bit x 8" long) |
| 39 | PP-6 | PUNCH (3/16" bit x 7" long) |
| 40 | 719 | WRENCH, vise grip (7") |
| 41 | 712-A | PLIER (slip joint, 8") |
| 42 | BP-32 | HAMMER (ball peen) |
| 43 | SS-83 | SCREWDRIVER (1/4" shank) |
| 44 | SS-123 | SCREWDRIVER (3/8" shank) |
| 45 | DA-12 | WRENCH (12" adjustable) |

TOOL SET
(13 Piece)



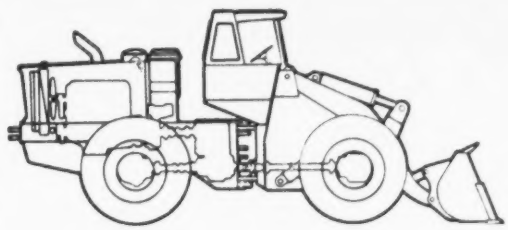

PL-43351-1A

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | TOOL SET (Consists of twelve tools and leatherette tool roll) (Also see "Special Tools" in this Section) (I.H. Part No. 276 822 R91) (See NOTE) |
| 1 | ED-1133 | ROLL, tool (Leatherette) |
| 2 | BP-32 | HAMMER (2 lb. - ball peen) |
| 3 | DA-12 | WRENCH (adjustable - 12" long) |
| 4 | SS-123 | SCREWDRIVER (3/8" shank) |
| 5 | SS-83 | SCREWDRIVER (1/4" shank) |
| 6 | TP-24 | PUNCH (10" long) |
| 7 | CC-24 | CHISEL (8" long) |
| 8 | 1712-A | PLIERS (slip joint - 8" long) |
| 9 | E-2426 | WRENCH, end (3/4 x 13/16") |
| 10 | E-2628 | WRENCH, end (13/16 x 7/8") |
| 11 | E-2022 | WRENCH, end (5/8 x 11/16") |
| 12 | E-1820 | WRENCH, end (9/16 x 5/8") |
| 13 | E-1416 | WRENCH, end (7/16 x 1/2") |

NOTE: Order individual tools and complete tool set from International Harvester Company, Parts & Service Development Department, 600 Woodfield, Schaumburg, Illinois, 60196.

# SECTION 3

# AIR



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* - Serial Number Not Available.

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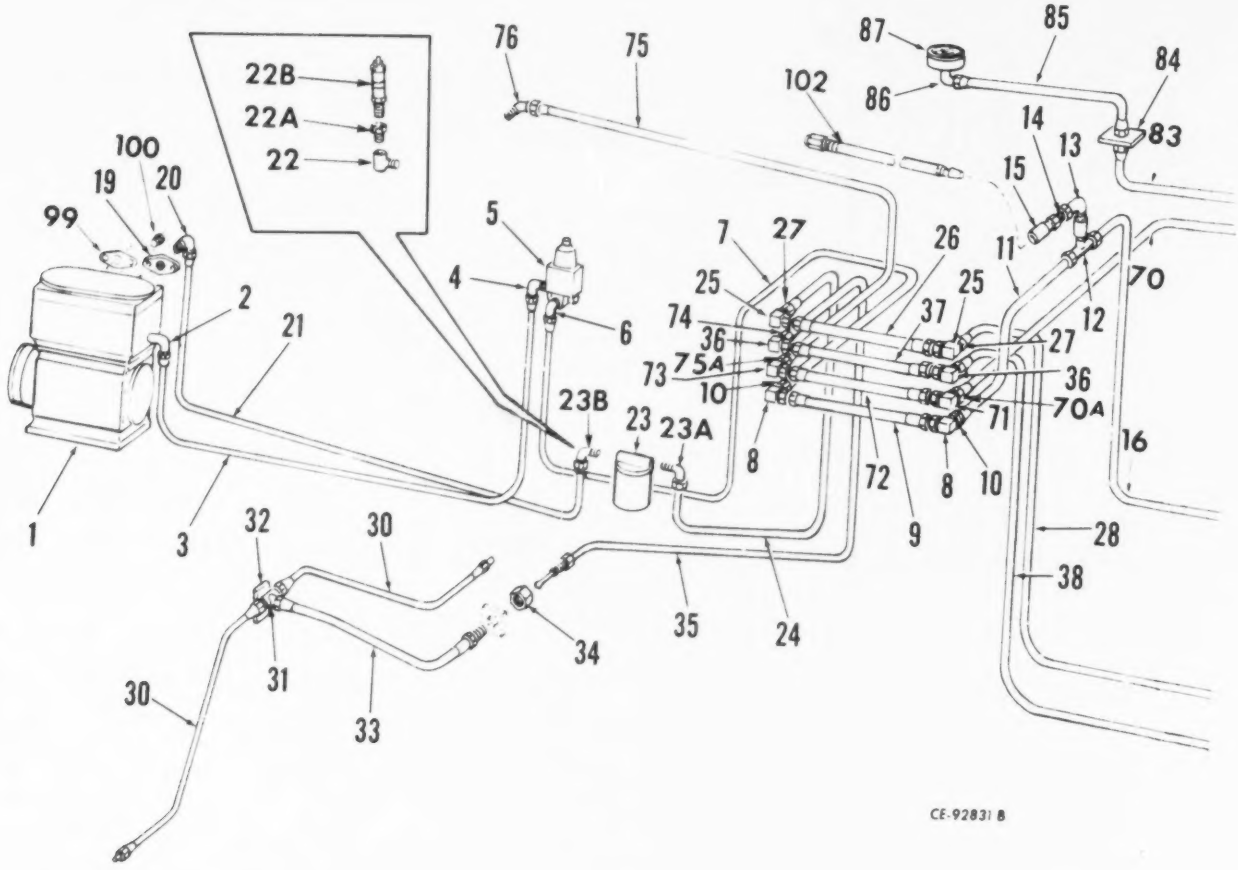
AIR SYSTEM PIPING
U001223 and below except 01220
C001254 and below





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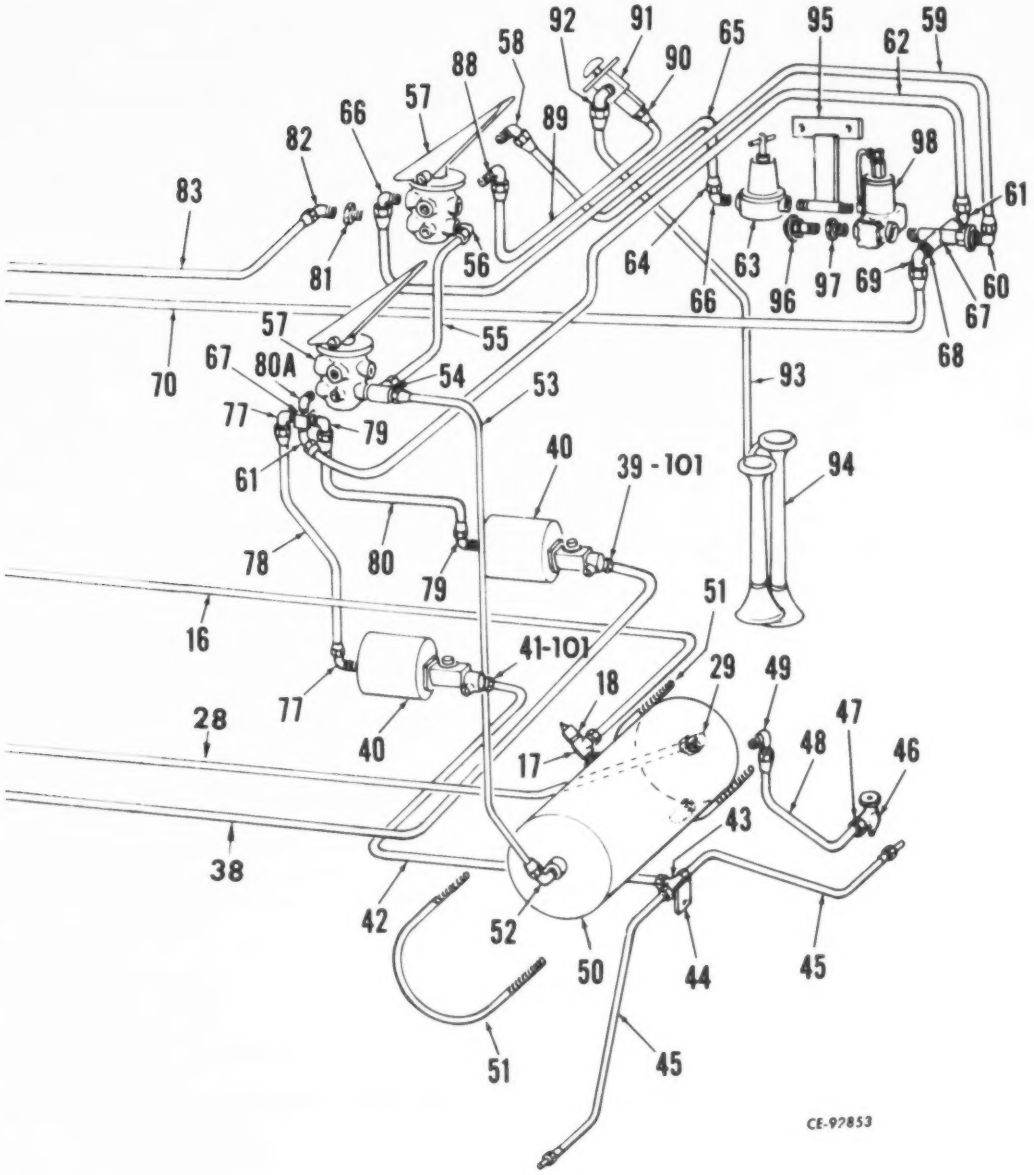
AIR SYSTEM PIPING - Continued
U001223 and below except 01220
C001254 and below



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR SYSTEM PIPING - Continued** |
| | | **U001223 and below except 01220** |
| | | **C001254 and below** |
| | | **LINE - COMPRESSOR TO GOVERNOR** |
| 1 | | COMPRESSOR (I.H. Engine - Refer to EPC-817B or 817C Parts Catalog) |
| 1 | | COMPRESSOR (Cummins Engine - Refer to Cummins Engine Manual) |
| 2 | 117 383 H1 | ELBOW (I.H.) |
| 2 | 110 902 H1 | ELBOW, swivel at compressor (Cummins) |
| 3 | 215 613 H1 | HOSE (I.H.) |
| 3 | 216 052 H1 | HOSE (Cummins) |
| 4 | 215 466 H1 | ELBOW |
| 5 | | GOVERNOR (See Governor in this Section) |
| | 186 303 | 5/16NF x 3-1/4" BOLT (2) |
| | 103 320 | 5/16" lock WASHER (2) |
| | 103 025 | 5/16NF hex NUT (2) |
| | | **LINE - RESERVOIR TO GOVERNOR** |
| 6 | 140 367 H1 | ELBOW |
| 7 | 195 093 H1 | TUBE |
| 8 | 202 804 H1 | ADAPTER (2) |
| 9 | 195 090 H1 | HOSE |
| 10 | 9 403 486 | NUT, tube (2) |
| 11 | 195 088 H1 | TUBE w/o NUT |
| | 29 898 D | NUT, tube |
| 12 | 941 271 C1 | TEE, w/o NUT |
| | 414 504 C1 | INSERT |
| 13 | 103 487 H1 | ELBOW |
| 14 | 124 976 H1 | NIPPLE |
| 15 | 105 411 | CAP (Not used on units equipped with Tire inflation) |
| 15 | 155 464 H1 | VALVE (Used on units equipped with Tire Inflation) |
| 16 | 122 696 H1 | TUBE w/o NUT |
| | 29 898 D | NUT, tube |
| 17 | 971 599 R1 | TEE, 164 250 H1, w/NUT, 30 773 V and SLEEVE 30 774 V |
| 18 | | VALVE, safety (See Safety Valve in this Section) |
| | | **LINE - COMPRESSOR TO ALCOHOL INJECTOR** |
| 19 | 60 697 R1 | FITTING, discharge (I.H.) |
| 20 | 444 044 | ELBOW |
| 21 | 159 052 H1 | HOSE |
| 22 | 444 138 | TEE U0* and below C001252 and below |
| 22A | 444 032 | BUSHING U0* and below C001252 and below |
| 22B | | VALVE, safety (See Safety Valve in this Section) U0* and below C001252 and below |
| 23 | | INJECTOR, alcohol (See Alcohol Injector in this Section) |
| | 181 364 | BOLT, 3/8NF x 1" (2) |
| | 103 321 | WASHER, 3/8" lock (2) |
| | 103 026 | NUT, 3/8NF hex (2) |
| 23A | 55 916 R11 | ELBOW |
| 23B | 444 044 | ELBOW U0* and up C001253 and up |
| | | **LINE - ALCOHOL INJECTOR TO RESERVOIR** |
| 24 | 878 344 C1 | TUBE |
| 25 | 178 816 H1 | ADAPTER (2) |
| 26 | 195 087 H1 | HOSE |
| 27 | 9403 490 | NUT, tube (2) |
| 28 | 195 433 H1 | TUBE |
| 29 | 444 043 | ELBOW |

* - Serial Number Not Available.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**AIR SYSTEM PIPING - Continued**
**U001223 and below except 01220**
**C001254 and below**

**LINE - LEFT HAND POWER CLUSTER TO REAR AXLE BRAKES**

| | | |
|---|---|---|
| 30 | 122 204 H1 | TUBE (2) |
| 31 | 179 804 H1 | TEE |
| 32 | 186 617 H1 | SEAT |
| | 181 314 | 1/4NF x 7/8" BOLT |
| | 103 319 | 1/4" lock WASHER |
| | 103 024 | 1/4"NF hex NUT |
| 33 | 879 016 C1 | HOSE, tube to tee |
| 34 | 194 150 H1 | NUT |
| 35 | 195 098 H1 | TUBE & NUT ASSEMBLY |
| 36 | 195 091 H2 | ADAPTER (2) |
| 37 | 195 092 H1 | HOSE |
| 38 | 892 651 C1 | TUBE & NUT ASSEMBLY |
| 39 | HL-3553 | ADAPTER |
| 40 | | CLUSTER, power (See Power Cluster in this Section) (2) |
| | 103 322 | 7/16" lock WASHER (6) |
| | 271 505 | 7/16"NF hex NUT (6) |

**LINE - RIGHT HAND POWER CLUSTER TO FRONT AXLE BRAKES**

| | | |
|---|---|---|
| 41 | HL-3553 | ADAPTER |
| | HL-3753 | GASKET |
| 42 | 121 111 H1 | TUBE & NUT ASSEMBLY |
| 43 | 179 804 H1 | TEE |
| 44 | 186 617 H1 | SEAT |
| | 181 314 | 1/4NF x 7/8" BOLT |
| | 103 319 | 1/4" lock WASHER |
| | 103 024 | 1/4"NF hex NUT |
| 45 | 122 204 H1 | TUBE & NUT ASSEMBLY (2) |

**LINE - RESERVOIR DRAIN**

| | | |
|---|---|---|
| 46 | 139 439 H1 | DRAIN, cock |
| 47 | 30 775 VX | CONNECTOR |
| 48 | 121 518 H1 | TUBE |
| 49 | 96 644 R11 | ELBOW |
| 50 | 148 733 R91 | RESERVOIR |
| 51 | 153 525 H1 | "U" BOLT (2) |
| | 17 234 R1 | 3/8"NF - 24 Esna NUT (4) |

**LINE - RESERVOIR TO RIGHT HAND BRAKE VALVE**

| | | |
|---|---|---|
| 52 | 698 559 R91 | ELBOW |
| 53 | 896 532 C1 | TUBE |
| 54 | 179 841 H1 | TEE |

**LINE - RIGHT HAND BRAKE VALVE TO LEFT HAND BRAKE VALVE**

| | | |
|---|---|---|
| 55 | 163 785 H1 | TUBE |
| 56 | 698 559 R91 | ELBOW |
| 57 | | VALVE, brake (See Brake Valve in this Section) (2) |
| | 181 339 | 5/16NF x 1" BOLT (6) |
| | 103 025 | 5/16"NF hex NUT (6) |
| | 103 320 | 5/16" lock WASHER (6) |

**LINE - LEFT HAND BRAKE VALVE TO LEFT HAND CHECK VALVE**

| | | |
|---|---|---|
| 58 | 941 047 C1 | ELBOW w/o NUT |
| | 414 505 C1 | INSERT |
| 59 | | TUBE w/o NUT, cut length 3/8" OD x 38" long cut from bulk hose 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR SYSTEM PIPING - Continued** |
| | | **U001223 and below except 01220** |
| | | **C001254 and below** |
| 60 | 42 411 D | ELBOW w/o NUT |
| | 414 505 C1 | INSERT |
| | | **LINE - LEFT HAND CHECK VALVE TO RIGHT HAND CHECK VALVE** |
| 61 | 42 411 D | ELBOW w/o NUT (2) |
| | 414 505 C1 | INSERT (2) |
| 62 | | TUBE w/o NUT, cut length 3/8" OD x 43" long cut from bulk hose 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| | | **LINE - REGULATOR TO LEFT HAND BRAKE VALVE** |
| 63 | | REGULATOR, pressure (See Pressure Regulator in this Section) |
| 64 | 37 288 H | NUT |
| 65 | | TUBE, nylon w/o tube NUTS, (cut length 1/2" OD x 30" long)(Cut from bulk TUBE, 417 200 C1) |
| | 37 288 H | NUT, 1/2" tube (2) |
| 66 | 68 134 D | ELBOW w/o NUT (2) |
| | 414 506 C1 | INSERT (2) |
| | | **LINE - LEFT HAND CHECK VALVE TO TRANSMISSION DISCONNECT** |
| 67 | | VALVE, check (See Check Valve in this Section) (2) |
| 68 | 127 875 | BUSHING |
| 69 | 140 367 H1 | ELBOW |
| 70 | 195 437 H1 | TUBE |
| 70A 9 | 403 486 | NUT, tube |
| 71 | 202 804 H1 | ADAPTER |
| 72 | 195 090 H1 | HOSE & NUT ASSEMBLY |
| 73 | 153 482 H1 | ADAPTER |
| 74 9 | 410 057 | NUT, lock |
| 75 | 195 459 H1 | TUBE |
| 75A 9 | 403 486 | NUT, tube |
| 76 | 140 367 H1 | ELBOW |
| | | **LINE - RIGHT HAND CHECK VALVE TO RIGHT HAND POWER CLUSTER** |
| 77 | 42 411 D | ELBOW w/o NUT (2) |
| | 414 505 C1 | INSERT (2) |
| 78 | | TUBE w/o NUT, cut length 3/8" OD x 30" cut from bulk hose 417 199 C2 |
| | 37 165 D | 3/8" tube NUT (2) |
| | | **LINE - RIGHT HAND CHECK VALVE TO LEFT HAND POWER CLUSTER** |
| 79 | 42 411 D | ELBOW w/o NUT (2) |
| | 414 505 C1 | INSERT (2) |
| 80 | 175 776 H1 | TUBE |
| 80A | 877 310 C1 | ELBOW |
| | | **LINE - LEFT HAND BRAKE VALVE TO PRESSURE GAUGE** |
| 81 | 144 050 | BUSHING |
| 82 | 19 715 R1 | ELBOW w/o NUT |
| 83 | | TUBE w/o NUT, cut length 1/8"OD x 54" long cut from bulk hose 417 195 C2 |
| | 36 092 D | 1/8" tube NUT (2) |
| 84 | 943 939 C1 | ADAPTER w/o NUT |
| 85 | | TUBE w/o NUT, cut length 1/8"OD x 22" long cut from bulk hose 417 195 C2 |
| | 36 092 D | 1/8" tube NUT (2) |
| 86 | 19 715 R1 | CONNECTOR, w/o NUT |
| 87 | | GAUGE, air pressure (See Electrical Gauges in Section 11) |



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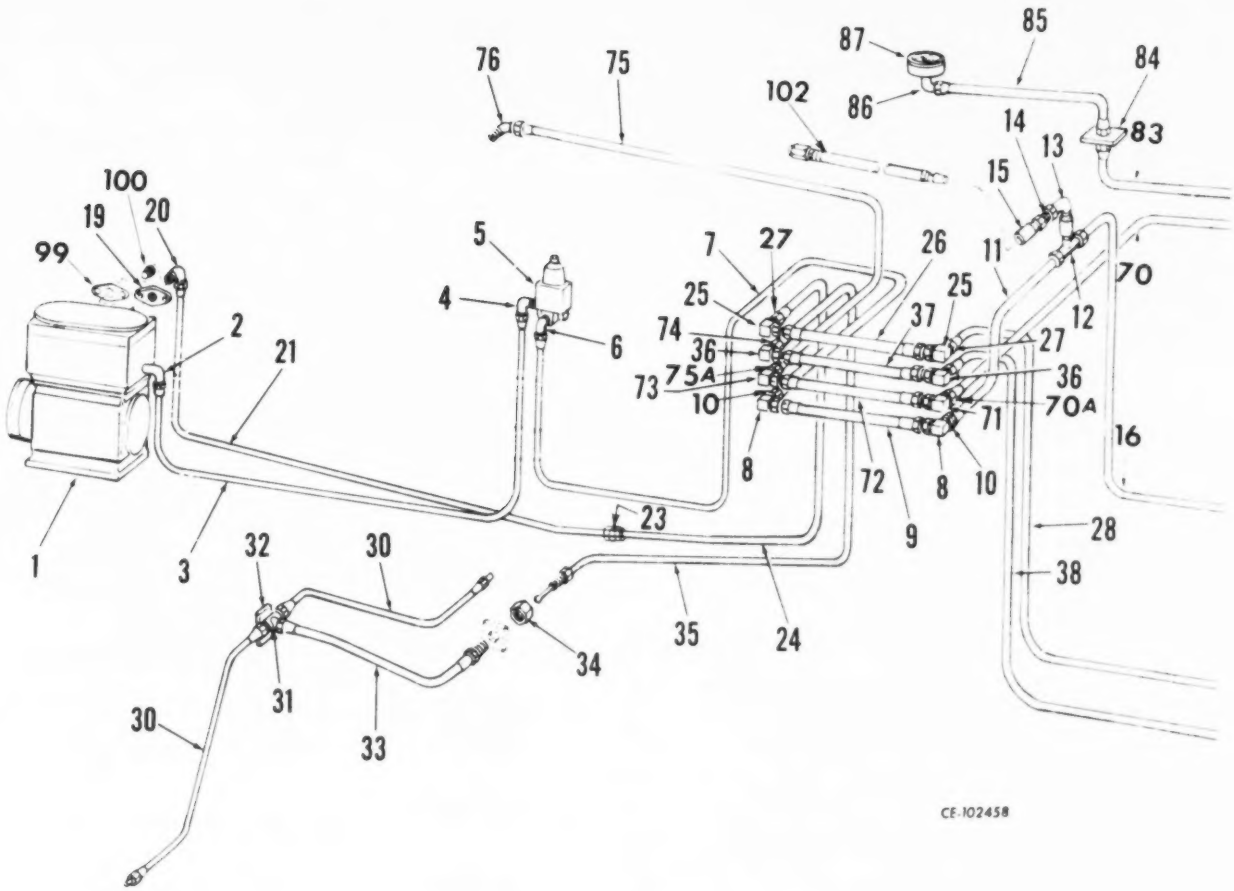
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR SYSTEM PIPING - Continued** |
| | | **U001223 and below except 01220** |
| | | **C001254 and below** |
| | | **LINE - BRAKE VALVE TO VALVE HORN** |
| 88 | 252 374 R1 | ELBOW, w/o NUT |
| | 414 504 C1 | INSERT |
| 89 | | TUBE w/o NUT, cut length 1/4"OD x 7" long cut from bulk hose 417 196 C2 |
| | 29 898 D | 1/4" tube NUT (2) |
| 90 | 59 730 H | CONNECTOR w/o NUT |
| | 414 504 C1 | INSERT |
| 91 | | VALVE, horn (See Air Horn in this Section) |
| | 181 315 | 1/4NF x 1" BOLT (2) |
| | 103 024 | 1/4"NF hex NUT (2) |
| | 103 319 | 1/4" lock WASHER (2) |
| | | **LINE - HORN VALVE TO AIR HORN** |
| 92 | 30 402 D | ELBOW w/o NUT |
| | 414 504 C1 | INSERT |
| 93 | | TUBE w/o NUT, cut length 1/4"OD x 28" long cut from bulk hose 417 196 C2 |
| | 29 898 D | 1/4" tube NUT (2) |
| 94 | | HORN, air (See Air Horn in this Section) |
| | 181 340 | 5/16NF x 1-1/4" BOLT |
| | 103 025 | 5/16"NF hex NUT |
| | 103 320 | 5/16" lock WASHER |
| 95 | 878 171 C2 | SUPPORT |
| 96 | 131 586 H1 | BREATHER |
| 97 | 175 778 H1 | BUSHING, reducer |
| 98 | | VALVE, air solenoid (See Solenoid Valve in this Section) |
| 99 | 153 606 H1 | GASKET |
| 100 | 128 140 | BUSHING, reducer (Cummins) |
| 101 | HL-3753 | GASKET |
| 102 | 217 999 H1 | HOSE (Used on units equipped with Tire Inflation Kit) |
| | 164 250 H1 | BODY (Part of Tee, 971 599 R91) |
| | HA-1351 | CLAMP, right hand power cluster to front axle brakes |
| | HA-1351 | CLAMP, reservoir to right hand brake valve (2) |
| | 109 084 | NUT, 1/4NC (2) |
| | 103 319 | WASHER, 1/4 lock (2) |
| | 140 578 | CLAMP, air compressor to governor (Cummins) (2) |
| | 140 578 | CLAMP, air supply valve to reservoir |
| | 140 578 | CLAMP, governor to air supply valve |
| | 103 320 | 5/16" lock WASHER |
| | 102 634 | 5/16" hex NUT |
| | 102 818 H1 | CLAMP, alcohol injector tubing |
| | 102 818 H1 | CLAMP, governor to air supply valve |
| | 102 818 H1 | CLAMP, fuel reservoir tubing |
| | 132 112 H1 | CLAMP, air compressor to governor (I.H.) |
| | 156 609 H1 | CLAMP, right hand power cluster to front axle brakes |
| | 167 195 H1 | CLAMP, left hand power cluster to rear axle brake |
| | 181 343 | 5/16NF x 1-1/2" BOLT (2) |
| | 103 320 | 5/16" lock WASHER (2) |
| | 103 025 | 5/16"NF hex NUT (2) |
| | 167 195 H1 | CLAMP, right hand power cluster to front axle (2) |
| | 181 345 | 1/4NF x 7/8 BOLT (2) |
| | 103 319 | 1/4" lock WASHER (2) |
| | 103 024 | 1/4"NF hex NUT (2) |
| | 444 163 | ELBOW, stoplight switch to cluster |
| | 417 195 C2 | HOSE, bulk, 1/8" x 50 feet (x) |
| | 417 196 C2 | HOSE, bulk, 1/4" x 50 feet (x) |
| | 417 199 C2 | HOSE, bulk, 3/8" x 50 feet (x) |
| | 417 200 C1 | HOSE, bulk, 1/2" x 50 feet (x) |
| | 30 773 V | NUT, tube (Part of Tee 971 599 R91) |
| | 30 774 V | SLEEVE (Part of Tee 971 599 R91) |

(x) - As Required.

AIR SYSTEM PIPING
U001224 thru 01255 also 01220
C001255 thru 01303



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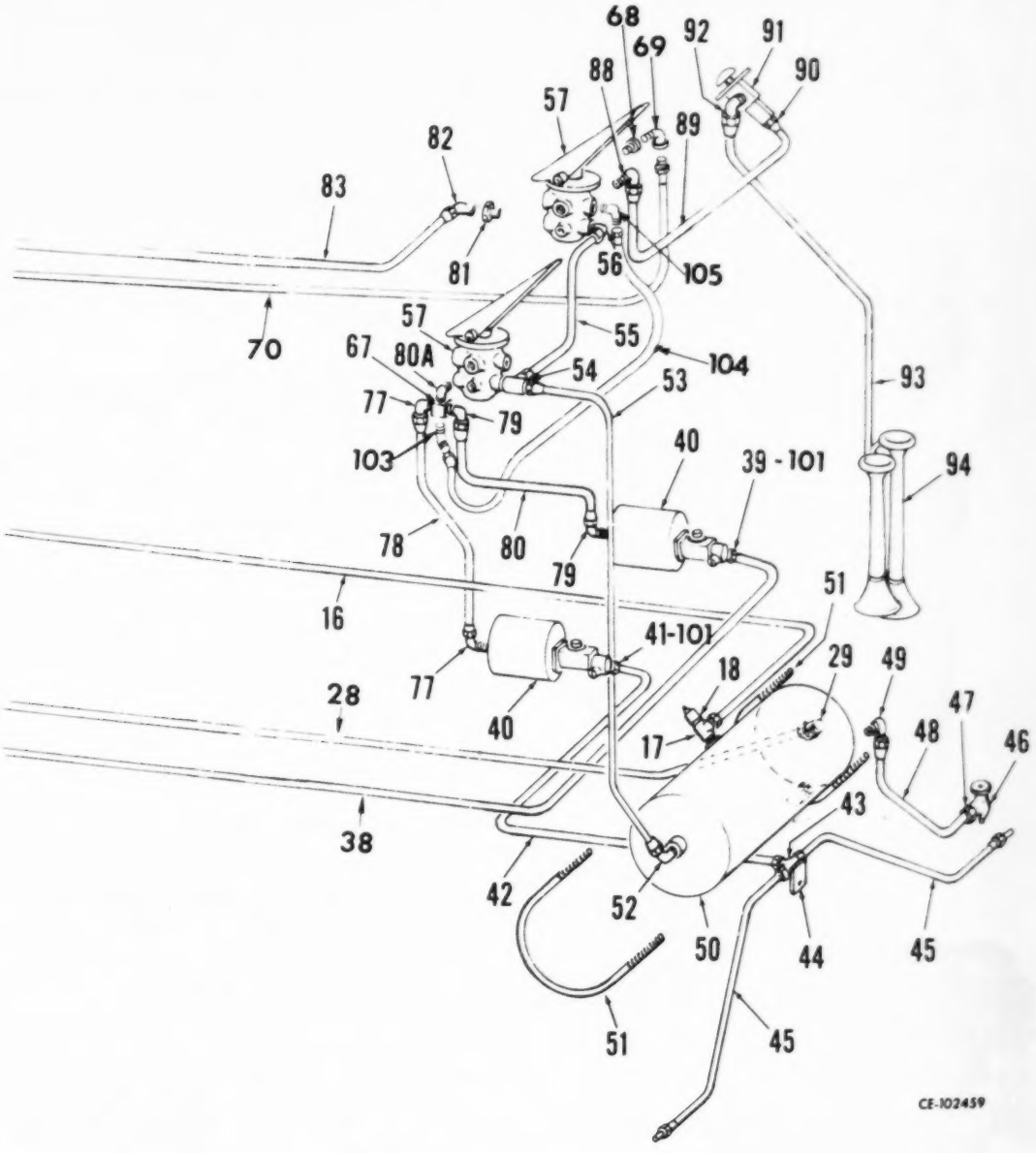
AIR SYSTEM PIPING
U001224 thru 01255 also 01220
C001255 thru 01303



AIR SYSTEM PIPING - Continued
U001224 thru 01255 also 01220
C001255 thru 01303

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **LINE - COMPRESSOR TO GOVERNOR** |
| 1 | | COMPRESSOR (I.H. Engine - Refer to EPC-817B or 817C Parts Catalog) |
| 1 | | COMPRESSOR (Cummins Engine - Refer to Cummins Engine Manual) |
| 2 | 117 383 H1 | ELBOW (I.H.) |
| 2 | 110 902 H1 | ELBOW, swivel at compressor (Cummins) |
| 3 | 215 613 H1 | HOSE (I.H.) |
| 3 | 216 052 H1 | HOSE (Cummins) |
| 4 | 215 466 H1 | ELBOW |
| 5 | | GOVERNOR (See Governor in this Section) |
| | 186 303 | BOLT, 5/16NF x 3-1/4" (2) |
| | 103 320 | WASHER, 5/16" lock (2) |
| | 103 025 | NUT, 5/16NF hex (2) |
| | | **LINE - RESERVOIR TO GOVERNOR** |
| 6 | 140 367 H1 | ELBOW |
| 7 | 195 093 H1 | TUBE |
| 8 | 202 804 H1 | ADAPTER (2) |
| 9 | 195 090 H1 | HOSE |
| 10 | 9 403 486 | NUT, tube (2) |
| 11 | 195 088 H1 | TUBE w/o NUT |
| | 29 898 D | NUT, tube |
| 12 | 941 271 C1 | TEE, w/o NUT |
| | 414 504 C1 | INSERT |
| 13 | 103 487 H1 | ELBOW |
| 14 | 124 976 H1 | NIPPLE |
| 15 | 105 411 | CAP (Not used on units equipped with Tire Inflation) |
| 15 | 155 464 H1 | VALVE (Used on units equipped with Tire Inflation) |
| 16 | 122 696 H1 | TUBE w/o NUT |
| | 29 898 D | NUT, tube |
| 17 | 971 599 R1 | TEE, 164 250 H1, w/NUT, 30 773 V and SLEEVE, 30 774 V |
| 18 | | VALVE, safety (See Safety Valve in this Section) |
| | | **LINE - COMPRESSOR TO ALCOHOL INJECTOR** |
| 19 | 60 697 R1 | FITTING, discharge (I.H.) |
| 20 | 444 044 | ELBOW |
| 21 | 159 052 H1 | HOSE |
| 23 | 60 702 R11 | CONNECTOR |
| | | **LINE - ALCOHOL INJECTOR TO RESERVOIR** |
| 24 | 878 344 C1 | TUBE |
| 25 | 178 816 H1 | ADAPTER (2) |
| 26 | 195 087 H1 | HOSE |
| 27 | 9 403 490 | NUT, tube (2) |
| 28 | 195 433 H1 | TUBE |
| 29 | 444 043 | ELBOW |
| | | **LINE - LEFT HAND POWER CLUSTER TO REAR AXLE BRAKES** |
| 30 | 122 204 H1 | TUBE (2) |
| 31 | 179 804 H1 | TEE |
| 32 | 186 617 H1 | SEAT |
| | 181 314 | BOLT, 1/4NF x 7/8" |
| | 103 319 | WASHER, 1/4" lock |
| | 103 024 | NUT, 1/4" NF hex |
| 33 | 879 016 C1 | HOSE, tube to tee |
| 34 | 194 150 H1 | NUT |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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

AIR SYSTEM PIPING - Continued
U001224 thru 01255 also 01220
C001255 thru 01303

LINE - LEFT HAND POWER CLUSTER TO REAR AXLE BRAKES

| | | |
|---|---|---|
| 35 | 195 098 H1 | TUBE & NUT ASSEMBLY |
| 36 | 195 091 H2 | ADAPTER (2) |
| 37 | 195 092 H1 | HOSE |
| 38 | 892 651 C1 | TUBE & NUT ASSEMBLY |
| 39 | HL-3553 | ADAPTER |
| 40 | | CLUSTER, power (See Power Cluster in this Section) (2) |
| | 103 322 | WASHER, 7/16" lock (6) |
| | 271 505 | NUT, 7/16"NF hex (6) |

LINE - RIGHT HAND POWER CLUSTER TO FRONT AXLE BRAKES

| | | |
|---|---|---|
| 41 | HL-3553 | ADAPTER |
| | HL-3753 | GASKET |
| 42 | 121 111 H1 | TUBE & NUT ASSEMBLY |
| 43 | 179 804 H1 | TEE |
| 44 | 186 617 H1 | SEAT |
| | 181 314 | BOLT, 1/4NF x 7/8" |
| | 103 319 | WASHER, 1/4" lock |
| | 103 024 | NUT, 1/4"NF hex |
| 45 | 122 204 H1 | TUBE & NUT ASSEMBLY (2) |

LINE - RESERVOIR DRAIN

| | | |
|---|---|---|
| 46 | 139 439 H1 | DRAIN, cock |
| 47 | 30 775 VX | CONNECTOR |
| 48 | 121 518 H1 | TUBE |
| 49 | 96 644 R11 | ELBOW |
| 50 | 148 733 R91 | RESERVOIR |
| 51 | 153 525 H1 | "U" BOLT (2) |
| | 17 234 R1 | NUT, 3/8"NF - 24 Esna (4) |

LINE - RESERVOIR TO RIGHT HAND BRAKE VALVE

| | | |
|---|---|---|
| 52 | 698 559 R91 | ELBOW |
| 53 | 896 532 C1 | TUBE |
| 54 | 179 841 H1 | TEE |

LINE - RIGHT HAND BRAKE VALVE TO LEFT HAND BRAKE VALVE

| | | |
|---|---|---|
| 55 | | TUBE, w/o NUT, cut length 1/2"OD x 13" long cut from bulk TUBE, 417 200 C1 |
| | 47 128 H | NUT, 1/2" tube (2) |
| 56 | 698 559 R91 | ELBOW |
| 57 | | VALVE, brake (See Brake Valve in this Section) (2) |
| | 181 339 | BOLT, 5/16NF x 1" (6) |
| | 103 025 | NUT, 5/16"NF hex (6) |
| | 103 320 | WASHER, 5/16" lock (6) |

LINE - LEFT HAND CHECK VALVE TO TRANSMISSION DISCONNECT

| | | |
|---|---|---|
| 67 | | VALVE, check (See Check Valve in this Section) (2) |
| 68 | 144 051 | BUSHING |
| 69 | 252 374 R1 | ELBOW w/o NUT |
| | 414 504 C1 | INSERT |
| 70 | 122 696 H1 | TUBE w/o NUT |
| | 29 898 D | NUT, tube |
| 70A | 9 403 486 | NUT, tube |
| 71 | 202 804 H1 | ADAPTER |
| 72 | 195 090 H1 | HOSE & NUT ASSEMBLY |
| 73 | 153 482 H1 | ADAPTER |
| 74 | 9 410 057 | NUT, lock |
| 75 | 195 459 H1 | TUBE |
| 75A | 9 403 486 | NUT, tube |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR SYSTEM PIPING - Continued** |
| | | **U001224 thru 01255 also 01220** |
| | | **C001255 thru 01303** |
| | | **LINE - LEFT HAND CHECK VALVE TO TRANSMISSION DISCONNECT – Continued** |
| 76 | 140 367 H1 | ELBOW |
| | | **LINE - RIGHT HAND CHECK VALVE TO RIGHT HAND POWER CLUSTER** |
| 77 | 42 411 D | ELBOW w/o NUT (2) |
| | 414 505 C1 | INSERT (2) |
| 78 | | TUBE w/o NUT, cut length 3/8" OD x 30" cut from bulk hose, 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| | | **LINE - RIGHT HAND CHECK VALVE TO LEFT HAND POWER CLUSTER** |
| 79 | 175 777 H1 | ELBOW (2) |
| 80 | 175 776 H1 | TUBE |
| 80A | 877 310 C1 | ELBOW |
| | | **LINE - LEFT HAND BRAKE VALVE TO PRESSURE GAUGE** |
| 81 | 144 050 | BUSHING |
| 82 | 36 637 D | ELBOW, w/o NUT |
| 83 | | TUBE w/o NUT, cut length 1/8"OD x 54" long cut from bulk hose, 417 195 C2 |
| | 36 092 D | NUT, 1/8" tube (2) |
| 84 | 943 939 C1 | ADAPTER w/o NUT |
| 85 | | TUBE w/o NUT, cut length 1/8"OD x 22" long cut from bulk hose, 417 195 C2 |
| | 36 092 D | NUT, tube (2) |
| 86 | 19 715 R1 | CONNECTOR w/o NUT |
| 87 | | GAUGE, air pressure (See Electrical Gauges in Section 11) |
| | | **LINE - BRAKE VALVE TO VALVE HORN** |
| 88 | 252 374 R1 | ELBOW w/o NUT |
| | 414 504 C1 | INSERT |
| 89 | | TUBE w/o NUT, cut length 1/4"OD x 7" long cut from bulk hose, 417 196 C2 |
| | 29 898 D | NUT, 1/4" tube (2) |
| 90 | 59 730 H | CONNECTOR, w/o NUT |
| | 414 504 C1 | INSERT |
| 91 | | VALVE, horn (See Air Horn in this Section) |
| | 181 315 | BOLT, 1/4NF x 1" (2) |
| | 103 024 | NUT, 1/4" NF hex (2) |
| | 103 319 | WASHER, 1/4" lock (2) |
| | | **LINE - HORN VALVE TO AIR HORN** |
| 92 | 30 402 D | ELBOW, 90° w/o NUT |
| | 414 504 C1 | INSERT |
| 93 | | TUBE w/o NUT, cut length 1/4" OD x 28" long cut from bulk hose, 417 196 C2 |
| | 29 898 D | NUT, 1/4" tube (2) |
| 94 | | HORN, air (See Air Horn in this Section) |
| | 181 340 | BOLT, 5/16NF x 1-1/4" |
| | 103 025 | NUT, 5/16" NF hex |
| | 103 320 | WASHER, 5/16" lock |
| 95 | 878 171 C2 | SUPPORT |
| 96 | 131 586 H1 | BREATHER |
| 97 | 175 778 H1 | BUSHING, reducer |
| 98 | | VALVE, air solenoid (See Solenoid Valve in this Section) |
| 99 | 153 606 H1 | GASKET |
| 100 | 128 140 | BUSHING, reducer (Cummins) |
| 101 | HL-3753 | GASKET |
| 102 | 217 999 H1 | HOSE (Used on units equipped with Tire Inflation) |



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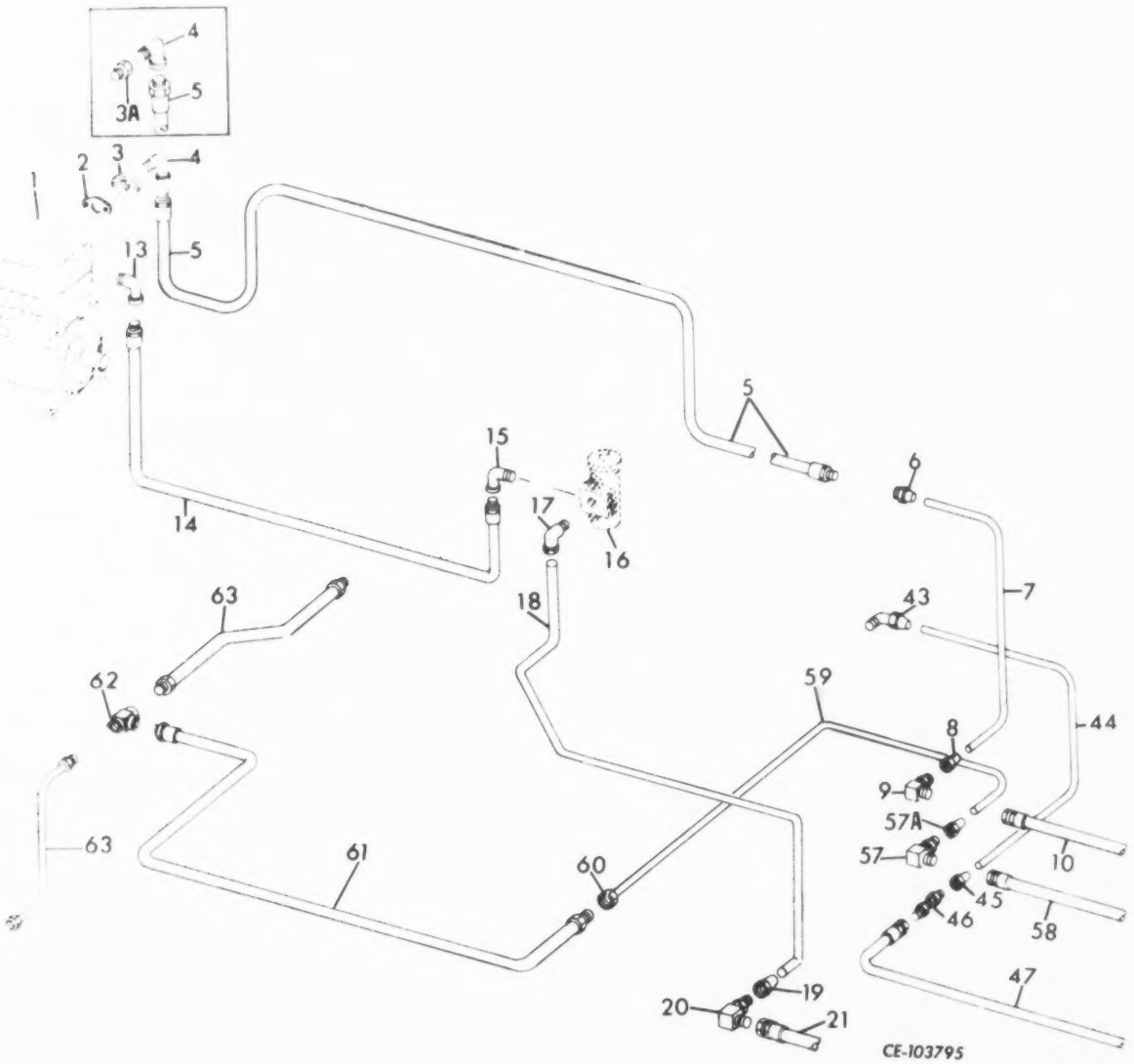
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR SYSTEM PIPING - Continued**<br>**U001224 thru 01255 also 01220**<br>**C001255 thru 01303** |
| 103 | 42 411 D<br>414 505 C1 | ELBOW, w/o NUT<br>INSERT |
| 104 | | TUBE, nylon w/o tube nuts (cut length 3/8"OD x 8" long) (cut from bulk TUBE, 417 199 C2) |
| | 37 165 D | NUT, 3/8" tube (2) |
| 105 | 941 047 C1<br>414 505 C1 | ELBOW, w/o NUT<br>INSERT |
| | 164 250 H1 | BODY (Part of Tee, 971 599 R91) |
| | HA-1351 | CLAMP, right hand power cluster to front axle brakes |
| | HA-1351 | CLAMP, reservoir to right hand brake valve (2) |
| | 109 084 | NUT, 1/4NC (2) |
| | 103 319 | WASHER, 1/4" lock (2) |
| | 140 578 | CLAMP, air compressor to governor (Cummins) (2) |
| | 140 578 | CLAMP, air supply valve to reservoir |
| | 140 578 | CLAMP, governor to air supply valve |
| | 103 320 | WASHER, 5/16" lock |
| | 102 634 | NUT, 5/16" hex |
| | 102 818 H1 | CLAMP, alcohol injector tubing |
| | 102 818 H1 | CLAMP, governor to air supply valve |
| | 102 818 H1 | CLAMP, fuel reservoir tubing |
| | 132 112 H1 | CLAMP, air compressor to governor (I.H.) |
| | 156 609 H1 | CLAMP, right hand power cluster to front axle brakes |
| | 167 195 H1 | CLAMP, left hand power cluster to rear axle brake |
| | 181 343 | BOLT, 5/16NF x 1-1/2" (2) |
| | 103 320 | WASHER, 5/16" lock (2) |
| | 103 025 | NUT, 5/16"NF hex (2) |
| | 167 195 H1 | CLAMP, right hand power cluster to front axle (2) |
| | 181 345 | BOLT, 1/4NF x 7/8 (2) |
| | 103 319 | WASHER, 1/4" lock (2) |
| | 103 024 | NUT, 1/4"NF hex (2) |
| | 444 163 | ELBOW, stoplight switch to cluster |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 417 195 C2 | HOSE, bulk, 1/8" x 50 feet (x) |
| | 417 196 C2 | HOSE, bulk, 1/4" x 50 feet (x) |
| | 417 199 C2 | HOSE, bulk, 3/8" x 50 feet (x) |
| | 417 200 C1 | TUBE, bulk, 1/2" x 50 feet (x) |
| | | KIT, tire inflation (Consists of HOSE, 217 999 H1 and INSTALLATION CHARGING FGH-11354) |
| | 30 773 V | NUT, tube (Part of Tee 971 599 R91) |
| | 30 774 V | SLEEVE (Part of Tee 971 559 R91) |

(x) - As Required.

AIR SYSTEM PIPING
U001256 thru 01540 except 01535 and 01537
thru 01539
C001304 and up





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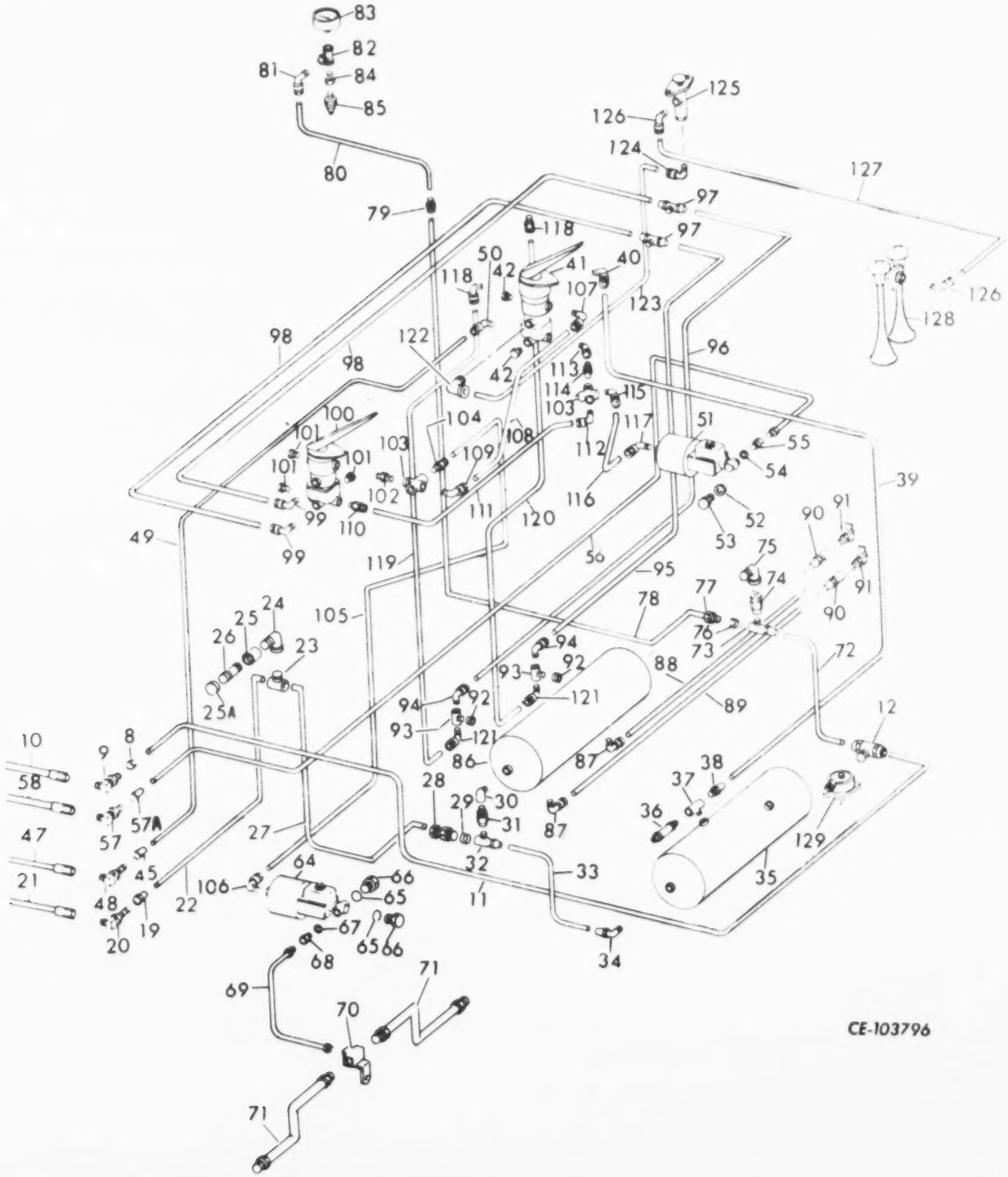
AIR SYSTEM PIPING - Continued
U001256 thru 01540 except 01535 and 01537
thru 01539
C001304 and up



AIR SYSTEM PIPING - Continued
U001256 thru 01540 except 01535 and 01537 thru 01539
C001304 and up

### LINE-COMPRESSOR TO WET RESERVOIR

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | COMPRESSOR, air (I.H. Engine - For components Refer to EPC-817B or 817C Parts Catalog) |
| 1 | | COMPRESSOR, air (Cummins Engine - For components Refer to Air Compressor in Cummins Engine Manual) |
| 2 | 92 474 H | GASKET (I.H. Engine) |
| 3 | 60 697 R1 | FITTING, discharge (I.H. Engine) |
| 3A | 128 140 | BUSHING, 3/4 to 1/2 pipe reducer (Cummins) |
| 4 | 444 044 | ELBOW, 1/2" St. |
| 5 | 159 052 H1 | HOSE |
| 6 | 60 702 R11 | CONNECTOR, 5/8 to 1/2 NPT |
| 7 | 878 344 C1 | TUBE |
| | 102 818 H1 | CLAMP |
| 8 | 9 403 490 | NUT, tube (2) |
| 9 | 178 816 H1 | ADAPTER, 90° (2) |
| 10 | 195 087 H1 | HOSE |
| 11 | 195 433 H1 | TUBE |
| | 102 818 H1 | CLAMP |
| 12 | 86 879 R11 | TEE, 5/8 to 1/2 NPT |

### LINE-COMPRESSOR TO GOVERNOR

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 13 | 444 166 | ELBOW, 1/4NPT (I.H. Engine) |
| 13 | 110 902 H1 | ADAPTER (Cummins Engine) |
| 14 | 215 613 H1 | HOSE (I.H. Engine) |
| | 132 112 H1 | CLAMP |
| 14 | 216 052 H1 | HOSE (Cummins Engine) |
| | 140 578 | CLAMP (Cummins Engine) |
| 15 | 444 163 | ELBOW, 1/8" NPT |

### LINE-GOVERNOR TO AUXILIARY AIR SUPPLY

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 16 | | GOVERNOR (For components see Governor in this Section) |
| | 186 303 | BOLT, 5/16NF x 3-1/4" (2) |
| | 103 320 | WASHER, 5/16 lock (2) |
| | 103 025 | NUT, 5/16NF hex (2) |
| 17 | 140 367 H1 | ELBOW, 1/4 to 1/8" NPT |
| 18 | 195 093 H1 | TUBE |
| | 102 818 H1 | CLAMP |
| | 140 578 | CLAMP |
| | 103 320 | WASHER, 5/16 lock |
| | 102 634 | NUT, 5/16 |
| 19 | 9 403 486 | NUT, tube (2) |
| 20 | 202 804 H1 | ADAPTER, 90° bulkhead (2) |
| 21 | 195 909 H1 | HOSE |
| 22 | 195 088 H1 | TUBE |
| | 29 898 D | NUT, tube |
| 23 | 941 271 C1 | TEE, 1/4 to 1/4" NPT |
| | 414 504 C1 | INSERT |
| 24 | 105 423 | ELBOW, 1/4" St. |
| 25 | 107 353 H1 | COUPLING |
| 25A | 105 411 | CAP, 1/4" |
| 26 | 105 405 | NIPPLE |

### AUXILIARY AIR SUPPLY TO TEE

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 27 | 137 453 H1 | TUBE, w/o NUT |
| | 140 578 | CLAMP |
| | 29 898 D | NUT, tube |
| 28 | 59 730 H | CONNECTOR, w/o NUT |
| | 414 504 C1 | INSERT |
| 29 | 119 928 | BUSHING, 1/4NPT to 3/8 NPT reducer |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**AIR SYSTEM PIPING - Continued**
**U001256 thru 01540 except 01535 and 01537 thru 01539**
**C001304 and up**

### LINE-PRIMARY RESERVOIR TO WET RESERVOIR

| | | |
|---|---|---|
| 30 | 444 044 | ELBOW |
| 31 | 198 034 H1 | VALVE, check (2) |
| 32 | 192 903 H1 | TEE, 5/8 tube to 1/2NPT to 3/8FPT |
| 33 | 161 171 H1 | TUBE |
| 34 | 55 916 R11 | ELBOW, 5/8 tube to 1/2 NPT |
| 35 | 148 733 R91 | RESERVOIR, air |
| | 153 525 H1 | "U" BOLT (2) |
| | 17 234 R1 | NUT, 3/8NF Esna (4) |

### LINE-WET RESERVOIR TO L.H. TREADLE VALVE

| | | |
|---|---|---|
| 36 | | VALVE, safety (For components see Safety Valve in this Section) |
| 37 | 444 134 | TEE, 1/4FPT (2) to 1/4 NPT |
| 38 | 59 730 H | CONNECTOR, w/o NUT |
| | 414 504 C1 | INSERT |
| 39 | | TUBE, w/o NUTS cut length 1/4"O.D. x 50" long cut from bulk TUBE, 417 196 C2 |
| | 29 898 D | NUT, 1/4" tube (2) |
| 40 | 30 402 D | ELBOW, w/o NUT |
| | 414 504 C1 | INSERT |
| 41 | | VALVE, treadle lefthand (For components see Left Hand Treadle Valve in this Section) |
| | 181 339 | BOLT, 5/16NF x 1" (3) |
| | 103 025 | NUT, 5/16NF hex (3) |
| | 103 320 | WASHER, 5/16 lock (3) |
| 42 | 445 686 | PLUG, 3/8 pipe (2) |

### LINE-LEFT HAND TREADLE VALVE TO TRANSMISSION DISCONNECT

| | | |
|---|---|---|
| 43 | 140 367 H1 | ELBOW, 1/4 tube to 1/8"NPT |
| 44 | 195 459 H1 | TUBE |
| 45 | 9 403 486 | NUT, tube (2) |
| 46 | 153 482 H1 | ADAPTER, bulkhead |
| 47 | 195 090 H1 | HOSE |
| 48 | 202 804 H1 | ADAPTER, 90° bulkhead |
| 49 | 122 696 H1 | TUBE w/o NUT |
| | 29 898 D | NUT, tube |
| 50 | 941 041 C1 | ELBOW, w/o NUT |
| | 414 504 C1 | INSERT |

### LEFT HAND POWER CLUSTER TO REAR AXLE BRAKES

| | | |
|---|---|---|
| 51 | | CLUSTER, power (For components see Power Cluster in this Section) |
| | 103 322 | WASHER, 7/16" lock (3) |
| | 271 505 | NUT, 7/16 hex (3) |
| 52 | 49 034 H | GASKET (2) |
| 53 | 49 035 H | PLUG (2) |
| 54 | 49 034 H | GASKET |
| 55 | 48 071 H | FITTING, outlet |
| 56 | 892 651 C1 | TUBE |
| | 140 568 | CLAMP |
| 57 | 195 091 H2 | ADAPTER, 90° bulkhead (2) |
| 57A | 9 403 486 | NUT, tube (2) |
| 58 | 195 092 H1 | HOSE |
| 59 | 195 098 H1 | TUBE |
| | 140 568 | CLAMP |
| 60 | 194 150 H1 | NUT |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **AIR SYSTEM PIPING - Continued U001256 thru 01540 except 01535 and 01537 thru 01539 C001304 and up** | | |
| 61 | 879 016 C1 | HOSE |
| 62 | 179 804 H1 | TEE, 1/2FPT (3) |
| | 181 314 | BOLT, 1/4NF x 7/8" |
| | 103 319 | WASHER, 1/4 lock |
| | 103 024 | NUT, 1/4" hex |
| 63 | 122 204 H1 | TUBE (2) |
| | 140 568 | CLAMP (2) |
| | 181 345 | BOLT, 5/16 NF x 1-3/4" (2) |
| | 103 320 | WASHER, 5/16" lock (2) |
| | 103 025 | NUT, 5/16" hex (2) |
| | 186 617 H1 | SEAT (2) |
| | | **LINE-RIGHT HAND POWER CLUSTER TO FRONT AXLE BRAKES** |
| 64 | | CLUSTER, power (For components see Power Cluster in this Section) |
| | 103 322 | WASHER, 7/16" lock (3) |
| | 271 505 | NUT, 7/16" hex (3) |
| 65 | 49 034 H | GASKET (2) |
| 66 | 49 035 H | PLUG (2) |
| 67 | 49 034 H | GASKET |
| 68 | 48 071 H | FITTING |
| 69 | 121 111 H1 | TUBE |
| | 156 609 H1 | CLAMP |
| 70 | 179 804 H1 | TEE, 1/2FPT (3) |
| | 181 314 | BOLT, 1/4NF x 7/8" |
| | 103 319 | WASHER, 1/4" lock |
| | 103 024 | NUT, 1/4" hex |
| 71 | 122 204 H1 | TUBE (2) |
| | 140 568 | CLAMP (2) |
| | 181 343 | BOLT, 5/16NF x 1-1/2" |
| | 103 320 | WASHER, 5/16" lock (2) |
| | 103 025 | NUT, 5/16" hex (2) |
| | 186 617 H1 | SEAT (2) |
| | | **LINE-TEE TO SECONDARY RESERVOIR** |
| 72 | 161 171 H1 | TUBE |
| 73 | 192 903 H1 | TEE, 5/8 tube to 1/2NPF to 3/8 FPT |
| 74 | 198 034 H1 | VALVE, check |
| 75 | 444 044 | ELBOW, 1/2" St. |
| | | **LINE-TEE TO AIR PRESSURE GAUGE** |
| 76 | 119 933 | BUSHING, 3/8NPT - 1/8NPT reducer |
| 77 | 59 939 D | CONNECTOR, w/o NUT |
| 78 | | TUBE w/o NUTS cut length 1/8" O.D. x 102" long cut from bulk TUBE, 417 195 C2 |
| | 36 092 D | NUT, 1/8" tube (2) |
| 79 | 943 939 C1 | ADAPTER, w/o NUT |
| 80 | | TUBE, w/o NUTS cut length 1/8" O.D. x 22" long cut from bulk TUBE, 417 195 C2 |
| | 36 092 D | NUT, tube (2) |
| 81 | 36 637 D | ELBOW, w/o NUT |
| 82 | 121 761 | TEE, 1/8FPT |
| 83 | | GAUGE, air pressure (See Instruments and Related Parts in Section 11) |
| 84 | 444 012 | BUSHING, 1/4FPT to 1/4 NPT |
| 85 | 879 677 C1 | SWITCH, air pressure |
| | | **LINE-RESERVOIR TO DRAIN VALVE** |
| 86 | 217 263 H1 | RESERVOIR, air |
| | 217 264 H1 | "U" BOLT (2) |
| | 17 234 R1 | NUT, 3/8 NF Esna (4) |
| 87 | 96 644 R11 | ELBOW, 1/4 tube to 1/4 NPT (2) |
| 88 | 219 916 H1 | TUBE, secondary reservoir to drain valve |
| 89 | 127 617 H1 | TUBE, primary reservoir to drain valve |
| 90 | 30 775 VX | CONNECTOR (2) |
| 91 | 25 450 H | VALVE, drain (2) |



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AIR SYSTEM PIPING - Continued
U001256 thru 01540 except 01535 and 01537 thru U01539
C001304 and up

### LINE-RESERVOIR TO RIGHT HAND TREADLE VALVE

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 92 | 128 140 | BUSHING, reducer (2) |
| 93 | 444 138 | TEE, 1/2FPT (2) to 1/2 (2) |
| 94 | 941 047 C1 | ELBOW, w/o NUT (2) |
| | 414 505 C1 | INSERT (2) |
| 95 | 895 945 C1 | TUBE |
| 96 | | TUBE, w/o NUTS cut length 3/8 O.D. x 51" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| 97 | 941 044 C1 | TEE, w/o NUT (2) |
| | 414 505 C1 | INSERT (2) |
| 98 | | TUBE, w/o NUTS cut length 3/8 O.D. x 12" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| 99 | 42 411 D | ELBOW, w/o NUT (2) |
| | 414 505 C1 | INSERT (2) |
| 100 | | VALVE, treadle right hand (For components see Treadle Valve in this Section) |
| | 181 339 | BOLT, 5/16NF x 1" (3) |
| | 103 025 | NUT, 5/16NF hex (3) |
| | 103 320 | WASHER, 5/16" lock (3) |
| 101 | 445 686 | PLUG, 3/8" pipe (2) |

### LINE - R.H. CHECK VALVE TO R.H. POWER CLUSTER

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 102 | 443 990 | BUSHING, 3/8NPT to 1/4NPT reducer |
| 103 | | VALVE, check (For components see Check Valve in this Section)(2) |
| 104 | 38 026 DM | CONNECTOR, w/o NUT |
| | 414 505 C1 | INSERT |
| 105 | | TUBE, w/o NUTS cut length 3/8 O.D. x 34" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| 106 | 42 411 D | ELBOW, w/o NUT |
| | 414 505 C1 | INSERT |

### LINE - L.H. TREADLE VALVE TO RIGHT HAND CHECK VALVE

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 107 | 42 411 D | ELBOW, 3/8 tube to 3/8 NPT |
| | 414 505 C1 | INSERT |
| 108 | | TUBE, w/o NUTS cut length 3/8 O.D. x 9" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| 109 | 37 323 D | ELBOW, w/o NUT 3/8 tube to 1/4 NPT |
| | 414 505 C1 | INSERT |

### LINE - R.H. TREADLE VALVE TO LEFT HAND CHECK VALVE

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 110 | 42 409 | CONNECTOR, w/o NUT |
| | 414 505 C1 | INSERT |
| 111 | | TUBE, w/o NUTS cut length 3/8 O.D. x 11" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| 112 | 37 323 D | ELBOW, w/o NUT |
| | 414 505 C1 | INSERT |

### LINE-LEFT HAND CHECK VALVE TO LEFT HAND POWER CLUSTER

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 113 | 126 039 | ELBOW, 45° 3/8 St. |
| 114 | 443 990 | BUSHING, 3/8NPT to 1/4NPT reducer |
| 115 | 37 323 D | ELBOW, w/o NUT |
| | 414 505 C1 | INSERT |
| 116 | | TUBE, w/o NUTS cut length 3/8 O.D. x 24" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8 tube (2) |
| 117 | 42 411 D | ELBOW, w/o NUT |
| | 414 505 C1 | INSERT |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR SYSTEM PIPING - Continued** |
| | | **U001256 thru 01540 except 01535 and 01537 thru 01539** |
| | | **C001304 and up** |
| | | **LINE-TEE TO LEFT HAND TREADLE VALVE** |
| 118 | 37 167 D | ELBOW, w/o NUT (2) |
| | 414 505 C1 | INSERT |
| 119 | | TUBE, w/o NUTS cut length 3/8 O.D. x 51" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8 tube (2) |
| 120 | | TUBE, w/o NUTS cut length 3/8 O.D. x 46" long cut from bulk TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8 tube (2) |
| 121 | 941 047 C1 | ELBOW, w/o NUT 3/8 to 1/2NPT (2) |
| | 414 505 C1 | INSERT (2) |
| | | **LINE-TREADLE VALVE TO AIR HORN VALVE** |
| 122 | 941 041 C1 | ELBOW, w/o NUT |
| | 414 504 C1 | INSERT |
| 123 | | TUBE, w/o NUTS cut length 1/4 O.D. x 10" long cut from bulk TUBE, 417 196 C2 |
| | 29 898 D | NUT, 1/4 tube (2) |
| 124 | 252 374 R1 | ELBOW, w/o NUT 1/4 to 1/4 NPT |
| | 414 504 C1 | INSERT |
| 125 | | VALVE, horn (For components see Air Horn and Valve in this Section) |
| | 181 315 | BOLT, 1/4NF x 1" (2) |
| | 103 024 | NUT, 1/4NF hex (2) |
| | 103 319 | WASHER, 1/4" lock (2) |
| | | **LINE-AIR HORN VALVE TO AIR HORN** |
| 126 | 30 402 D | ELBOW, w/o NUT (2) |
| | 414 504 C1 | INSERT (2) |
| 127 | | TUBE, w/o NUTS cut length 1/4 O.D. x 28" long cut from bulk TUBE, 417 196 C2 |
| | 29 898 D | NUT, 1/4" tube (2) |
| 128 | | HORN, air (For components see Air Horn in this Section) |
| | 181 341 | BOLT, 5/16 NF x 1-1/4" |
| | 103 025 | NUT, 5/16NF hex |
| | 103 320 | WASHER, 5/16 lock |
| 129 | 777 915 C92 | VALVE, drain (Refer to DRAIN VALVE) |
| | 417 196 C2 | TUBING, bulk 1/4" x 50 ft. (x) |
| | 417 199 C2 | TUBING, bulk 3/8" x 50 ft. (x) |
| | 444 163 | ELBOW, stoplight switch to cluster |

(x) - As Required.



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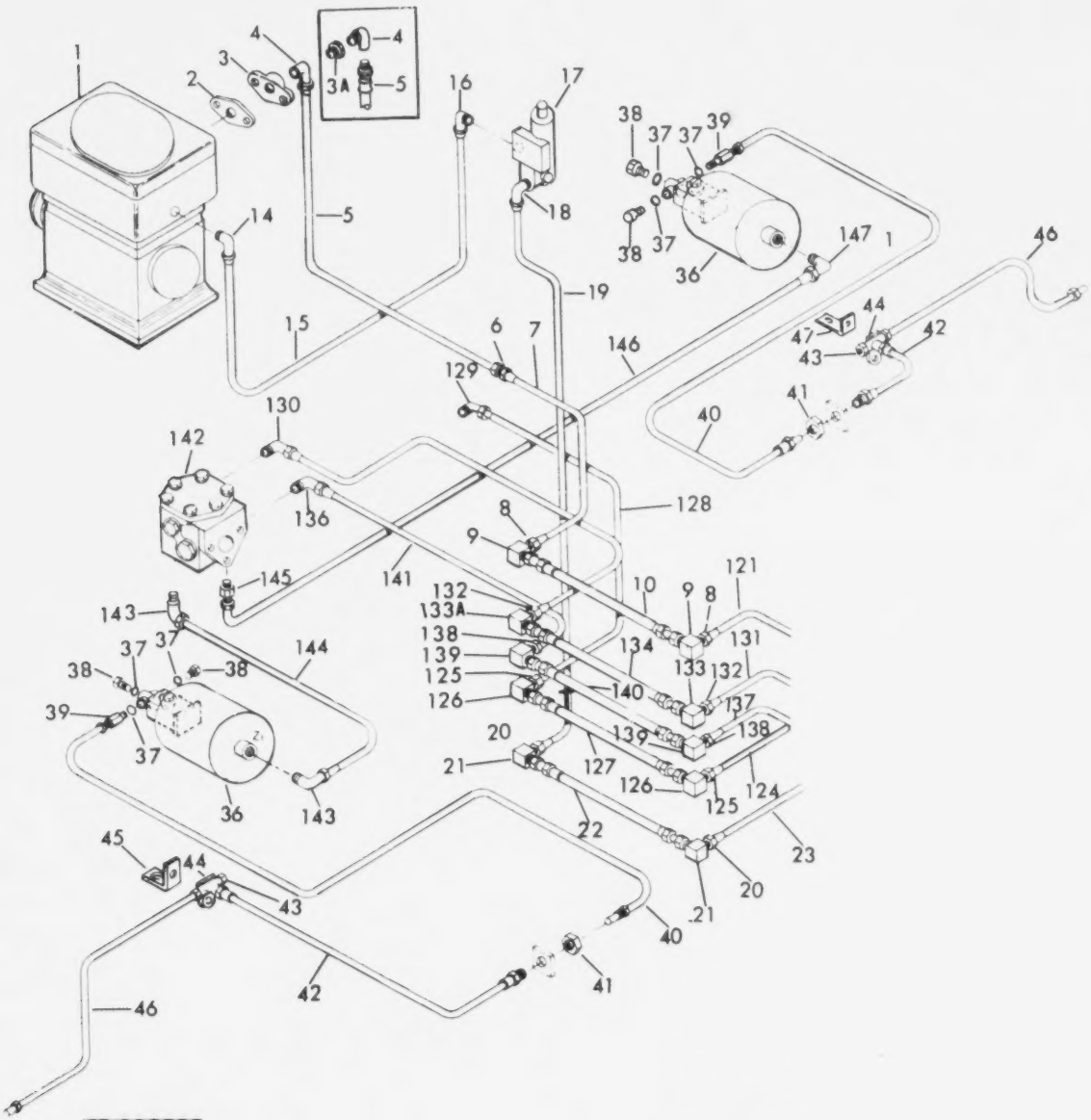
AIR SYSTEM PIPING
U001541 and up, and also 01535 and 01537
thru 01539
CO* and up



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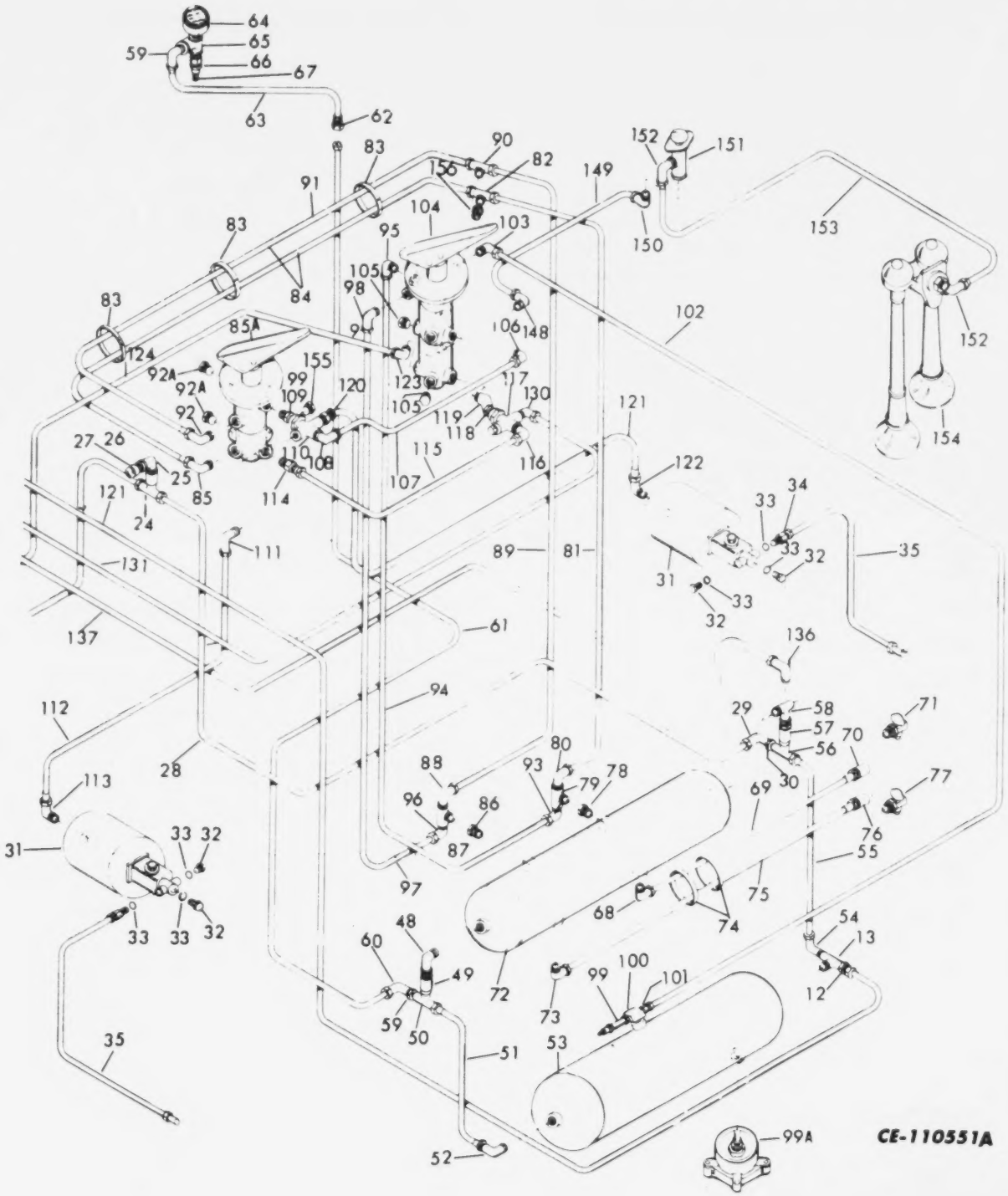
AIR SYSTEM PIPING
U001541 and up, and also 01535 and 01537
thru 01539
CO* and up



AIR SYSTEM PIPING - Continued
U001541 and up, and also 01535 and 01537 thru 01539
CO* and up

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **LINE-COMPRESSOR TO WET RESERVOIR** |
| 1 | | COMPRESSOR, air (I.H. Engine - Refer to EPC-817B or 817C Parts Catalog) |
| 1 | | COMPRESSOR, air (Cummins Engine - Refer to Cummins Engine Manual) |
| 2 | 92 474 H | GASKET |
| 3 | 60 697 R1 | FITTING, discharge (I.H. Engine) |
| 3A | 128 140 | BUSHING, pipe reducer (Cummins Engine) |
| 4 | 444 044 | ELBOW |
| 5 | 159 052 H1<br>HL 3551 | HOSE<br>CLAMP (2) |
| 6 | 60 702 R11 | CONNECTOR w/NUT |
| 7 | 878 344 C1<br>102 818 H1 | TUBE<br>CLAMP |
| 8 | 9 403 490 | NUT, tube (2) |
| 9 | 178 816 H1 | ADAPTER, bulkhead (2) |
| 10 | 195 087 H1 | HOSE |
| 11 | 195 433 H1 | TUBE |
| 12 | 698 562 R91 | CONNECTOR w/NUT |
| 13 | 444 138 | TEE |
| | | **LINE - COMPRESSOR TO GOVERNOR** |
| 14 | 444 166 | ELBOW (I.H. Engine) |
| 14 | 116 902 H1 | ADAPTER (Cummins Engine) |
| 15 | 215 613 H1<br>935 522 C1 | HOSE (I.H. Engine)<br>STRAP |
| 15 | 216 052 H1<br>140 578 | HOSE (Cummins Engine)<br>CLAMP |
| 16 | 444 163 | ELBOW |
| | | **LINE - GOVERNOR TO AUXILIARY AIR SUPPLY** |
| 17 | | GOVERNOR (Refer to Governor in this section) |
| 18 | 140 367 H1 | ELBOW |
| 19 | 195 093 H1<br>140 578<br>25 222 R1<br>25 542 R1<br>25 519 R1 | TUBE<br>CLAMP (2)<br>BOLT (2)<br>WASHER, flat (4)<br>NUT (2) |
| 20 | 9 403 486 | NUT, tube (2) |
| 21 | 202 804 H1 | ADAPTER, bulkhead (2) |
| 22 | 195 090 H1 | HOSE |
| 23 | 195 088 H1<br>29 898 D | TUBE<br>NUT, tube |
| 24 | 941 271 C1<br>414 504 C1 | BODY<br>EYELET (2) |
| 25 | 105 423 | ELBOW |
| 26 | 105 405 | NIPPLE |
| 27 | 105 411 | CAP |
| | | **LINE - AUXILIARY AIR SUPPLY TO TEE** |
| 28 | 137 453 H1<br>140 578<br>25 520 R1<br>29 898 D<br>25 543 R1 | TUBE<br>CLAMP<br>NUT, 5/16 N.C. clamp<br>NUT, tube (2)<br>WASHER, flat (2) |
| 29 | 164 839 H1<br>414 504 C1 | ELBOW<br>EYELET |
| 30 | 119 928 | BUSHING, reducer |

* Serial number not available.



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AIR SYSTEM PIPING - Continued
U001541 and up, and also 01535 and 01537 thru 01539
CO* and up

### LINE - FRONT POWER CLUSTER TO FRONT WHEELS

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 31 | | CLUSTER, power (Refer to Power Cluster in this section) (2) |
| 32 | 49 035 H | PLUG (4) |
| 33 | 49 034 H | GASKET (6) |
| 34 | 48 071 H | FITTING (2) |
| 35 | 180 554 H1 | TUBE (2) |
| | 140 568 | CLAMP (2) |
| | 25 750 R1 | BOLT (2) |
| | 25 543 R1 | WASHER, flat (4) |
| | 9 413 977 | NUT (2) |

### LINE - REAR POWER CLUSTERS TO REAR AXLE BRAKES

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 36 | | CLUSTER, power (Refer to Power Cluster in this section) (2) |
| 37 | 49 034 H | GASKET (6) |
| 38 | 49 035 H | PLUG (4) |
| 39 | 48 071 H | FITTING (2) |
| 40 | 129 229 H1 | TUBE (2) |
| 41 | 194 150 H1 | NUT, jam |
| 42 | 194 127 H1 | HOSE (2) |
| 43 | 179 806 H1 | PLUG |
| 44 | 121 144 H1 | TEE ASSEMBLY |
| 45 | 184 002 H1 | BRACKET (To Differential Carrier) |
| | 25 483 H1 | BOLT (Bracket to Tee) |
| | 25 542 R1 | WASHER, flat (Bracket to Tee) (2) |
| | 26 110 R1 | NUT (Bracket to Tee) |
| 46 | 173 825 H1 | TUBE (2) |
| | 140 568 | CLAMP |
| | 25 750 R1 | BOLT (2) |
| | 25 543 R1 | WASHER, flat (4) |
| | 9 413 977 | NUT (2) |
| 47 | 213 587 H1 | BRACKET (To Differential Carrier) |
| | 25 483 H1 | BOLT (Bracket to Tee) |
| | 25 542 R1 | WASHER, flat (Bracket to Tee) (2) |
| | 26 110 R1 | NUT (Bracket to Tee) |

### LINE - PRIMARY RESERVOIR TO WET RESERVOIR

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 48 | 444 044 | ELBOW |
| 49 | 198 034 H1 | VALVE, check |
| 50 | 192 903 H1 | TEE |
| 51 | 161 171 H1 | TUBE |
| 52 | 55 916 R11 | ELBOW,w/NUT |
| 53 | 148 733 R91 | RESERVOIR, air |
| | 153 525 H1 | "U" BOLT (2) |
| | 17 234 R1 | NUT, Esna (4) |

### LINE - TEE TO SECONDARY RESERVOIR

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 54 | 55 916 R11 | ELBOW w/NUT |
| 55 | 161 171 H1 | TUBE |
| 56 | 192 903 H1 | TEE |
| 57 | 198 034 H1 | VALVE, check |
| 58 | 444 152 | TEE |

### LINE - TEE TO AIR PRESSURE GAUGE

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 59 | 119 933 | BUSHING, reducer |
| 60 | 36 637 D | BODY |
| 61 | | HOSE, nylon w/o NUT (Cut length 1/8" O.D. x 102" long) (Cut from bulk HOSE, 417 195 C2) |
| | 36 092 D | NUT, tube (2) |
| 62 | 943 939 C1 | BODY |
| 63 | | HOSE, nylon w/o NUT (Cut length 1/8" O.D. x 22" long) (Cut from bulk HOSE, 417 195 C2) |
| | 36 092 D | NUT, tube (2) |
| 64 | | GAUGE, air pressure (Refer to Instruments and Related Parts) |
| 65 | 121 761 | TEE |
| 66 | 444 012 | BUSHING, reducer |
| 67 | 879 677 C1 | SWITCH, air pressure |

*Serial number not available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **AIR SYSTEM PIPING - Continued<br>U001541 and up, and also 01535 and 01537 thru 01539<br>CO* and up** | | |
| | **LINE - SECONDARY RESERVOIR TO DRAIN VALVE** | |
| 68 | 252 374 R1<br>414 504 C1 | BODY<br>EYELET |
| 69 | 127 618 H1<br>29 898 D | TUBE<br>NUT, tube |
| 70 | 30 775 VX | CONNECTOR |
| 71 | 25 450 H | VALVE, drain |
| | **LINE - PRIMARY RESERVOIR TO DRAIN VALVE** | |
| 72 | 217 263 H1<br>217 264 H1<br>25 522 R1 | RESERVOIR, primary air<br>"U" BOLT (2)<br>NUT (4) |
| 73 | 252 374 R1<br>414 504 C1 | BODY<br>EYELET |
| 74 | 935 464 C1 | STRAP (2) |
| 75 | 153 532 H1<br>29 898 D | TUBE<br>NUT, tube |
| 76 | 30 775 VX | CONNECTOR |
| 77 | 25 450 H | VALVE, drain |
| | **LINE - SECONDARY RESERVOIR TO RIGHT HAND TREADLE VALVE** | |
| 78 | 128 140 | BUSHING, reducer |
| 79 | 444 138 | TEE |
| 80 | 941 047 C1<br>414 505 C1 | BODY<br>EYELET |
| 81 | 895 945 C1<br>37 165 D | TUBE, w/o NUT<br>NUT, tube (2) |
| 82 | 941 044 C1<br>414 505 C1 | BODY<br>EYELET (2) |
| 83 | 935 464 C1 | STRAP (3) |
| 84 | <br>37 165 D | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 12" long) (Cut from bulk HOSE, 417 199 C2)<br>NUT, tube |
| 85 | 42 411 D<br>414 505 C1 | BODY<br>EYELET |
| 85A | | VALVE, right hand treadle (Refer to TREADLE VALVE) |
| | **LINE - PRIMARY RESERVOIR TO RIGHT HAND TREADLE VALVE** | |
| 86 | 128 140 | BUSHING, reducer |
| 87 | 444 138 | TEE |
| 88 | 941 047 C1<br>414 505 C1 | BODY<br>EYELET |
| 89 | <br>37 165 D | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 51" long) (Cut from bulk HOSE, 417 199 C2)<br>NUT, tube (2) |
| 90 | 941 044 C1<br>414 505 C1 | BODY<br>EYELET (2) |
| 91 | <br>37 165 D | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 12" long) (Cut from bulk HOSE, 417 199 C2)<br>NUT, tube (2) |
| 92 | 42 411 D<br>414 505 C1 | BODY<br>EYELET |
| 92A | 445 686 | PLUG, pipe (2) |
| | **LINE - TEE (SECONDARY TANK) TO L.H. TREADLE VALVE** | |
| 93 | 941 047 C1<br>414 505 C1 | BODY<br>EYELET |
| 94 | 895 945 C1<br>37 165 D | TUBE<br>NUT, tube (2) |
| 95 | 37 167 D<br>414 505 C1 | BODY<br>EYELET |
| | **LINE - TEE (PRIMARY TANK) TO L.H. TREADLE VALVE** | |
| 96 | 941 047 C1<br>414 505 C1 | BODY<br>EYELET |
| 97 | <br>37 165 D | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 51" long) (Cut from bulk HOSE, 417 199 C2)<br>NUT, tube (2) |
| 98 | 37 167 D<br>414 505 C1 | BODY<br>EYELET |

*Serial number not available



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**AIR SYSTEM PIPING - Continued**
**U001541 and up, and also 01535 and 01537 thru 01539**
**CO* and up**

**LINE - WET RESERVOIR TO L.H. TREADLE VALVE**

| | | |
|---|---|---|
| 99 | | VALVE, safety (Refer to (SAFETY VALVE) |
| 99A | | VALVE, drain (Refer to DRAIN VALVE) |
| 100 | 444 134 | TEE |
| 101 | 59 730 H | BODY |
| | 414 505 C1 | EYELET |
| 102 | | HOSE, nylon w/o NUT (Cut length 1/4" O.D. x 50" long) (Cut from bulk HOSE, 417 196 C2) |
| | 29 898 D | NUT, tube (2) |
| 103 | 30 402 D | BODY |
| | 414 504 C1 | EYELET |
| 104 | | VALVE, left hand treadle (Refer to TREADLE VALVE) |
| 105 | 445 686 | PLUG, pipe (2) |

**LINE - L.H. TREADLE VALVE TO R.H. CHECK VALVE**

| | | |
|---|---|---|
| 106 | 42 411 D | BODY |
| | 414 505 C1 | EYELET |
| 107 | | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 9" long) (Cut from bulk HOSE, 417 196 C2) |
| | 37 165 D | NUT, tube (2) |
| 108 | 37 323 D | BODY |
| | | EYELET |

**LINE - R.H. CHECK VALVE TO R.H. FRONT POWER CLUSTER**

| | | |
|---|---|---|
| 109 | 443 990 | BUSHING, reducer |
| 110 | | VALVE, check (Refer to CHECK VALVE) |
| 111 | 37 323 D | BODY |
| | 414 505 C1 | EYELET |
| 112 | | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 30" long) (Cut from bulk TUBE, 417 199 C2) |
| | 37 165 D | NUT, tube (2) |
| 113 | 42 411 D | BODY |
| | 414 505 C1 | EYELET |

**LINE - R.H. TREADLE VALVE TO L.H. CHECK VALVE**

| | | |
|---|---|---|
| 114 | 42 409 D | CONNECTOR |
| | 414 505 C1 | EYELET |
| 115 | | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 11" long) (Cut from bulk HOSE, 417 199 C2) |
| | 37 165 D | NUT, tube (2) |
| 116 | 37 323 D | BODY |
| | 414 505 C1 | EYELET |
| 117 | | VALVE, check (Refer to CHECK VALVE) |
| 118 | 443 990 | BUSHING, reducer |
| 119 | 126 039 | ELBOW |

**LINE - R.H. CHECK VALVE TO L.H. FRONT POWER CLUSTER**

| | | |
|---|---|---|
| 120 | 38 026 DM | BODY |
| | 414 505 C1 | EYELET |
| 121 | | HOSE, nylon w/o NUT (Cut length 3/8" O.D. x 43" long) (Cut from bulk HOSE, 417 199 C2) |
| | 37 165 D | NUT, tube (2) |
| 122 | | BODY |
| | | EYELET |

**LINE - L.H. TREADLE VALVE TO TRANSMISSION DISCONNECT**

| | | |
|---|---|---|
| 123 | 941 041 C1 | BODY |
| | 414 504 C1 | EYELET |
| 124 | 886 104 C1 | TUBE |
| | 935 464 C1 | STRAP (4) |
| | 29 898 D | NUT, tube |
| 125 | 9 403 486 | NUT, tube (2) |
| 126 | 153 482 H1 | ADAPTER, bulkhead (2) |
| 127 | 195 090 H1 | HOSE |
| 128 | 195 459 H1 | TUBE |
| 129 | 140 367 H1 | ELBOW |

* Serial number not available

AIR SYSTEM PIPING - Continued
U001541 and up, and also 01535 and 01537 thru 01539
CO* and up

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **LINE - L.H. CHECK VALVE TO RELAY VALVE** |
| 130 | 252 374 R1 | BODY (2) |
| | 414 504 C1 | EYELET (2) |
| 131 | 195 437 H1 | TUBE |
| | 29 898 D | NUT, tube |
| 132 | 9 403 486 | NUT, tube (2) |
| 133 | 153 482 H1 | ADAPTER |
| 133A | 202 804 H1 | ADAPTER |
| 134 | 195 090 H1 | HOSE |
| | 140 578 | CLAMP |
| | 103 320 | WASHER, lock |
| | 25 520 R1 | NUT |
| 135 | 125 747 H1 | TUBE |
| | 29 898 D | NUT, tube |
| | | **LINE-TEE (SECONDARY TANK) TO RELAY VALVE SUPPLY** |
| 136 | 55 916 R11 | ELBOW w/NUT |
| 137 | 195 434 H1 | TUBE |
| 138 | 9 403 490 | NUT, tube (2) |
| 139 | 178 816 H1 | ADAPTER (2) |
| 140 | 195 087 H1 | HOSE |
| 141 | 161 171 H1 | TUBE |
| | | **LINE - RELAY VALVE TO R.H. REAR POWER CLUSTER** |
| 142 | | VALVE, relay (Refer to RELAY VALVE) |
| 143 | 42 411 D | BODY (2) |
| | 414 505 C1 | EYELET (2) |
| 144 | 134 971 H1 | TUBE |
| | 37 165 D | NUT, tube (2) |
| | | **LINE-RELAY VALVE TO L.H. REAR POWER CLUSTER** |
| 145 | 42 409 D | BODY |
| | 414 505 C1 | EYELET |
| 146 | 129 687 H1 | TUBE |
| | 37 165 D | NUT, tube (2) |
| 147 | 42 411 D | BODY |
| | 414 505 C1 | EYELET |
| | | **LINE - L.H. TREADLE VALVE TO AIR HORN VALVE** |
| 148 | 941 041 C1 | BODY |
| | 414 504 C1 | EYELET |
| 149 | | TUBE, nylon w/o NUT (Cut length 1/4" O.D. x 10" long) (Cut from bulk HOSE, 417 196 C2) |
| | 29 898 D | NUT, tube (2) |
| 150 | 252 374 R1 | BODY |
| | 414 504 C1 | EYELET |
| 151 | | VALVE, horn (Refer to AIR HORN & VALVE) |
| | 181 315 | BOLT (2) |
| | 103 319 | WASHER, lock (2) |
| | 103 025 | NUT (2) |
| | | **LINE - AIR HORN VALVE TO AIR HORN** |
| 152 | 30 402 D | BODY |
| | 414 504 C1 | EYELET |
| 153 | | HOSE, nylon w/o NUT (Cut length 1/4" O.D. x 28" long) (Cut from bulk HOSE, 417 196 C2) |
| | 29 898 D | NUT, tube (2) |
| 154 | | HORN, air (Refer to AIR HORN & VALVE) |
| 155 | 444 632 | PLUG |
| 156 | 120 322 | REDUCER |
| | 181 341 | BOLT |
| | 103 320 | WASHER, lock |
| | 103 025 | NUT |
| | 444 163 | ELBOW, stoplight switch to cluster |
| | 417 195 C2 | HOSE, bulk 1/8" O.D. x 50 ft. (#) (x) |
| | 417 196 C2 | HOSE, bulk 1/4" O.D. x 50 ft. (#) (x) |
| | 417 199 C2 | HOSE, bulk 3/8" O.D. x 50 ft. (#) (x) |

(x) - As Required.

(#) - Part number and price covers on foot of bulk item.

*Serial number not available.



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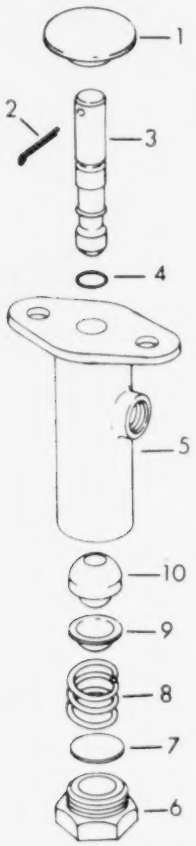
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

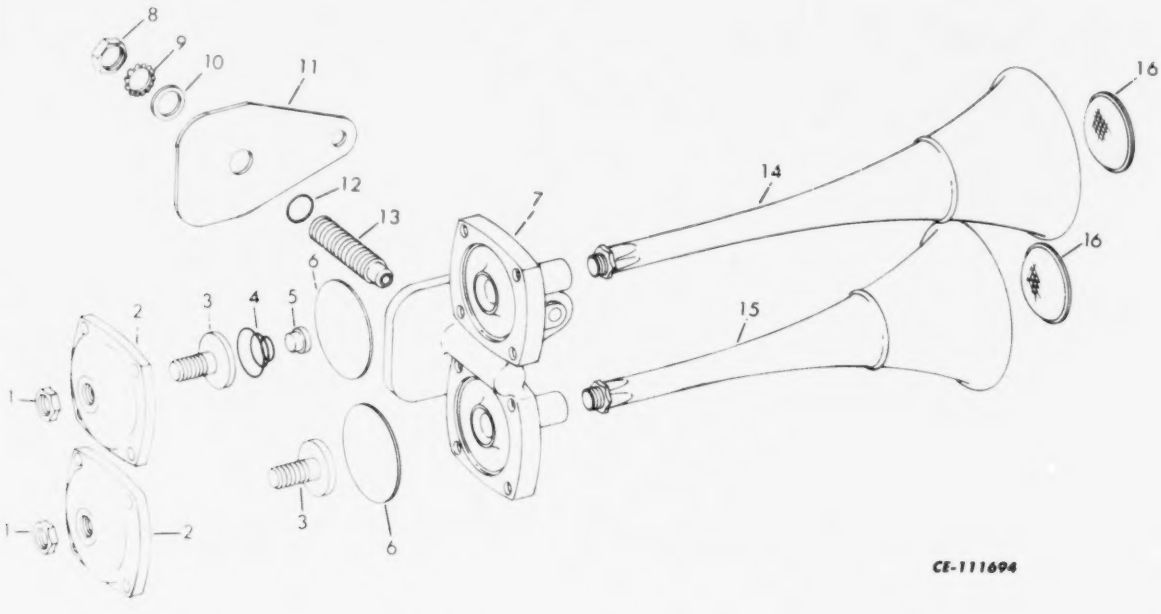
## AIR HORN VALVE




CE-111692

| | | |
|---|---|---|
| | 157 140 H1 | AIR HORN VALVE ASSEMBLY (Consists of · |
| 1 | 158 016 H1 | BUTTON |
| 2 | 103 373 | PIN, cotter |
| 3 | 158 012 H1 | STEM |
| 4 | 878 202 C1 | GROMMET, stem |
| 5 | | BODY (Not furnished separately) |
| 6 | | CAP (Not furnished separately) |
| 7 | 145 986 H1 | PLATE, strainer |
| 8 | 158 015 H1 | SPRING |
| 9 | 158 014 H1 | SEAT, spring |
| 10 | 158 013 H1 | VALVE, inlet |

AIR HORN
(Bendix Westinghouse)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 217 165 H1 | AIR HORN ASSEMBLY (Order AIR HORN, 1 101 318 C91 or 1 101 458 C91) (Consists of - |
| 1 | 25 520 R1 | NUT (2) |
| 2 | 145 998 H1 | COVER (2) |
| | 133 046 | SCREW, cap (8) |
| | 120 380 | WASHER (8) |
| 3 | 145 993 H1 | SPRING, seat (2) |
| 4 | 145 995 H1 | SPRING |
| 5 | 145 997 H1 | CONTACT, spring |
| 6 | 145 996 H1 | DIAPHRAGM (2) |
| 7 | 219 435 H1 | BODY |
| 8 | 124 944 | NUT |
| 9 | 115 553 | WASHER, lock |
| 10 | 145 991 H1 | WASHER |
| 11 | 145 999 H1 | GASKET |
| 12 | 352 221 R1 | "O" RING |
| 13 | 219 375 H1 | COUPLING, mounting |
| 14 | 145 990 H1 | BELL, long |
| 15 | 145 989 H1 | BELL, short |
| 16 | 146 001 H1 | SCREEN (2) |
| | 140 868 | SCREW, set (2) |



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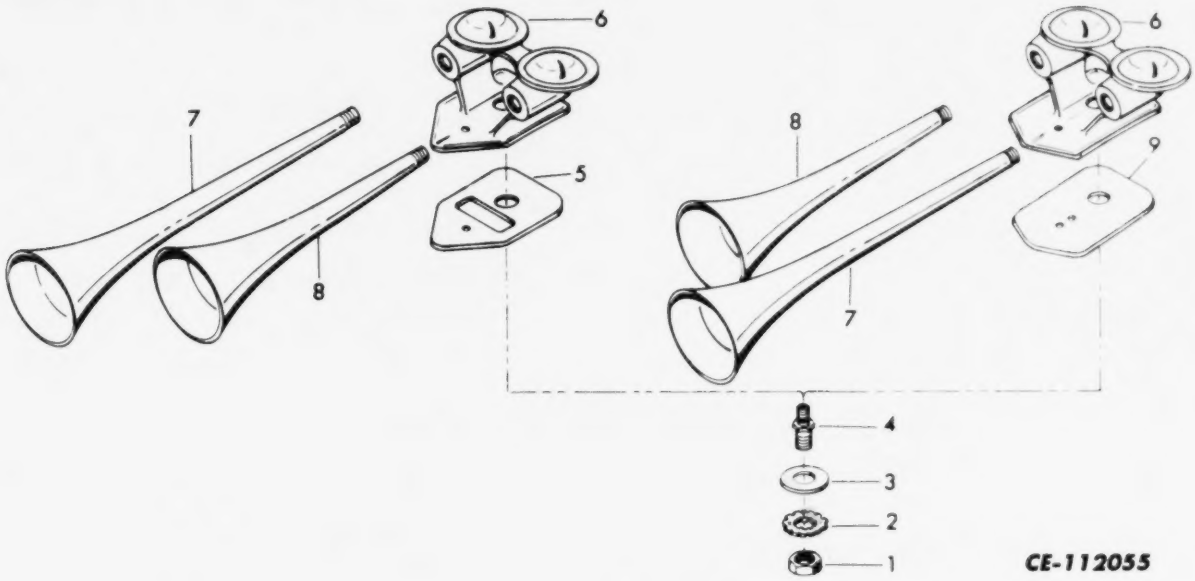
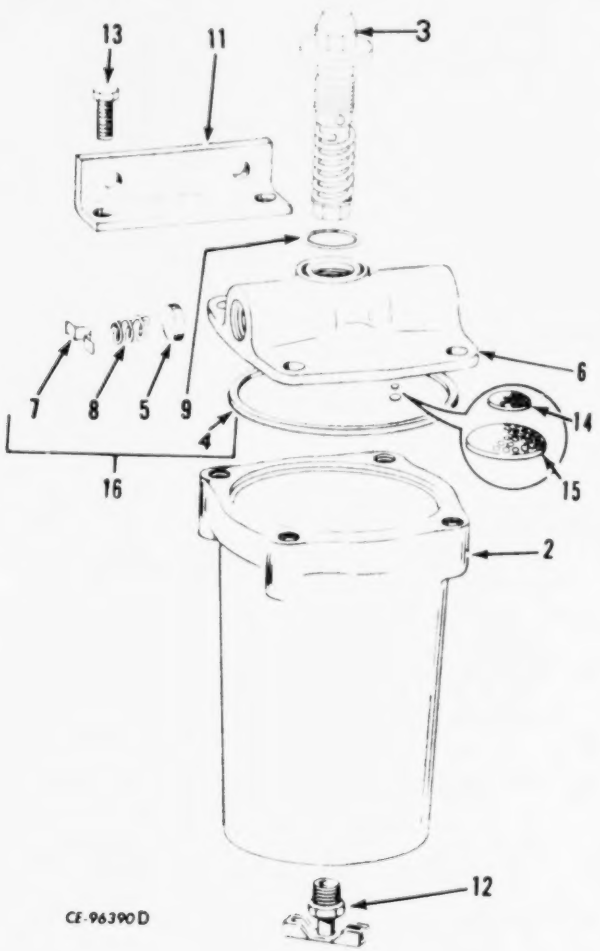
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

AIR HORN
(Signaltone or Spartan)




| | | |
|---|---|---|
| | 1 101 318 C91 | AIR HORN ASSEMBLY (Signaltone 23/32" dia. Projector) (Optional w/HORN, 1 101 458 C91) |
| | 1 101 458 C91 | AIR HORN ASSEMBLY (Spartan, 7/8" dia. Projector) (Optional w/HORN, 1 101 318 C91) (Consists of - |
| 1 | 25 676 R1 | NUT |
| 2 | 138 557 | WASHER, tooth |
| 3 | 130 999 | WASHER, plain (Part of HORN, 1 101 318 C91) |
| 3 | 1 101 510 C1 | WASHER, plain (Part of HORN, 1 101 458 C91) |
| 4 | 1 101 511 C1 | ADAPTER |
| 5 | 1 102 191 C1 | GASKET (Part of HORN, 1 101 318 C91) |
| 6 | | BODY (Not furnished separately) |
| 7 | 1 101 706 C1 | PROJECTOR, horn (Part of HORN, 1 101 318 C91) |
| 7 | 1 101 635 C1 | PROJECTOR, horn (Part of HORN, 1 101 458 C91) |
| 8 | 1 101 707 C1 | PROJECTOR, horn (Part of HORN, 1 101 318 C91) |
| 8 | 1 101 634 C1 | PROJECTOR, horn (Part of HORN, 1 101 458 C91) |
| 9 | 1 101 509 C1 | GASKET (Part of HORN, 1 101 458 C91) |

ALCOHOL INJECTOR
U001223 and below except 01220
C001254 and below




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 890 062 C93 | ALCOHOL INJECTOR (Consists of the following parts) |
| 2 | 344 132 C1 | RESERVOIR |
| 3 | 927 345 C1 | PLUG, w/safety valve, filler |
| 4 | | TETRASEAL, large (Not furnished separately) |
| 5 | | VALVE (Not furnished separately) |
| 6 | 930 404 C1 | COVER |
| 7 | | RETAINER (Not furnished separately) |
| 8 | | SPRING, return (Not furnished separately) |
| 9 | | TETRASEAL, small (Not furnished separately) |
| 11 | | BRACKET, mounting (Not furnished separately) (2) |
| 12 | 114 981 | COCK, drain |
| 13 | 172 462 | SCREW, 5/16" NF x 1" (4) |
| 14 | | STRAINER (Order COVER, 930 404 C1) |
| 15 | 347 547 R1 | RETAINER, strainer |
| 16 | 344 134 C91 | KIT, repair |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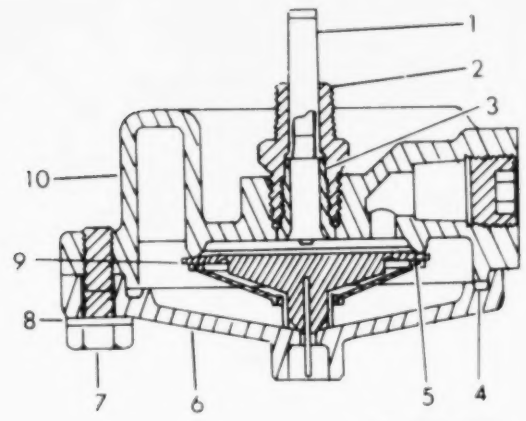
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## DRAIN VALVE




CE-109289

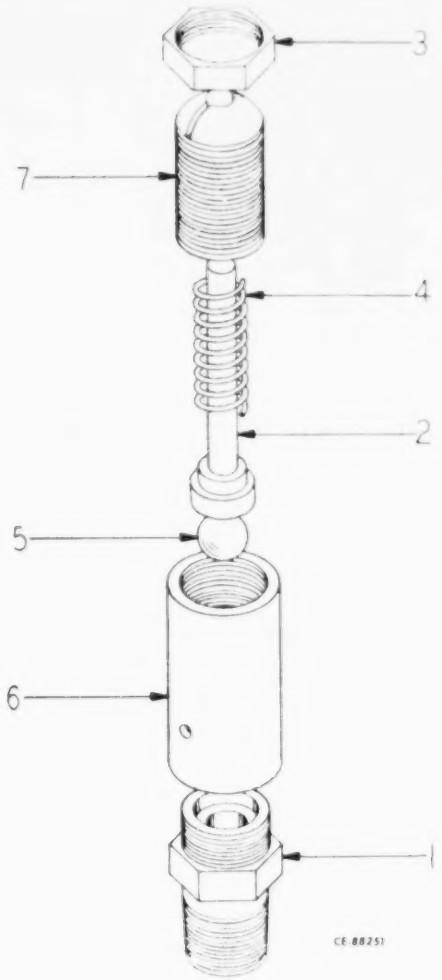
| | | |
|---|---|---|
| | 777 915 C92 | VALVE, automatic reservoir drain (Consists of the following parts - |
| 1 | | FILTER (Order KIT, 409 088 C91) |
| 2 | | ADAPTER (Not furnished separately) |
| 3 | | RETAINER, filter (Order KIT, 409 088 C91) |
| 4 | | SEAL (Order KIT, 409 088 C91) |
| 5 | | GUIDE, valve (Order KIT, 409 088 C91) |
| 6 | | COVER (Not furnished separately) |
| 7 | | SCREW, cap (Not furnished separately) (4) |
| 8 | | WASHER, lock (Not furnished separately) (4) |
| 9 | | VALVE, inlet and exhaust (Order KIT, 409 088 C91) |
| 10 | | BODY, valve (Not furnished separately) |
| | 409 088 C91 | KIT, drain valve maintenance (Consists of - |

§ 1 FILTER
§ 1 GUIDE, valve
§ 1 RETAINER, filter
§ 1 SEAL
§ 1 VALVE, inlet and exhaust)

§ - Not furnished separately.

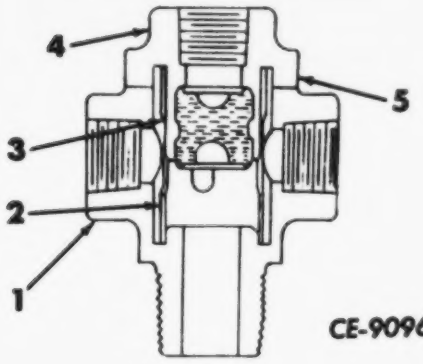
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## SAFETY VALVE



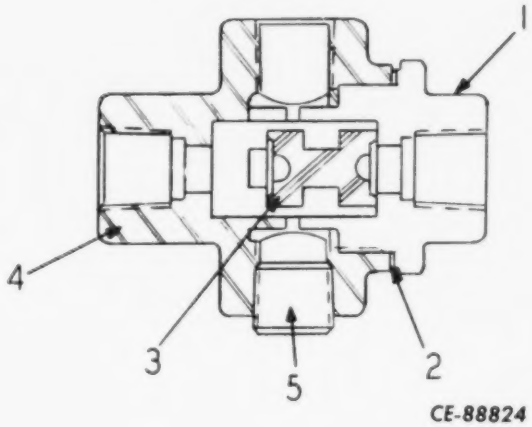

| | | |
|---|---|---|
| | 13-943 H | VALVE, safety (Consists of the following parts) (2) |
| 1 | 136 727 R1 | BODY |
| 2 | 136 730 R1 | PIN, release |
| 3 | 136 726 R1 | NUT, lock |
| 4 | 291 790 R1 | SPRING |
| 5 | 17 014 R1 | BALL |
| 6 | 136 728 R1 | CAGE, spring |
| 7 | 136 729 R1 | NUT, adjusting |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | CHECK VALVE<br>U001255 and below<br>C001303 and below |
| | 174 923 H1 | CHECK VALVE ASSEMBLY<br>(Consists of the following parts) (2) |
| 1 | 179 053 H2<br>236 182 R1 | BODY<br>SCREW w/lockwasher (2) |
| 2 | 179 067 H1 | GUIDE, shutter |
| 3 | 191 246 R1 | SHUTTER |
| 4 | 179 070 H2 | CAP |
| 5 | 177 625 H1 | "O" RING |



CE-90962

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | CHECK VALVE<br>U001256 and up<br>C001304 and up |
| | 215 321 H1 | VALVE ASSEMBLY<br>(Consists of the following parts) |
| 1 | 219 021 H1 | CAP |
| 2 | 219 003 H1 | GASKET |
| 3 | 219 075 H1 | SEAT |
| 4 | 219 076 H1 | BODY |
| 5 | 444 692 | PLUG |



CE-88824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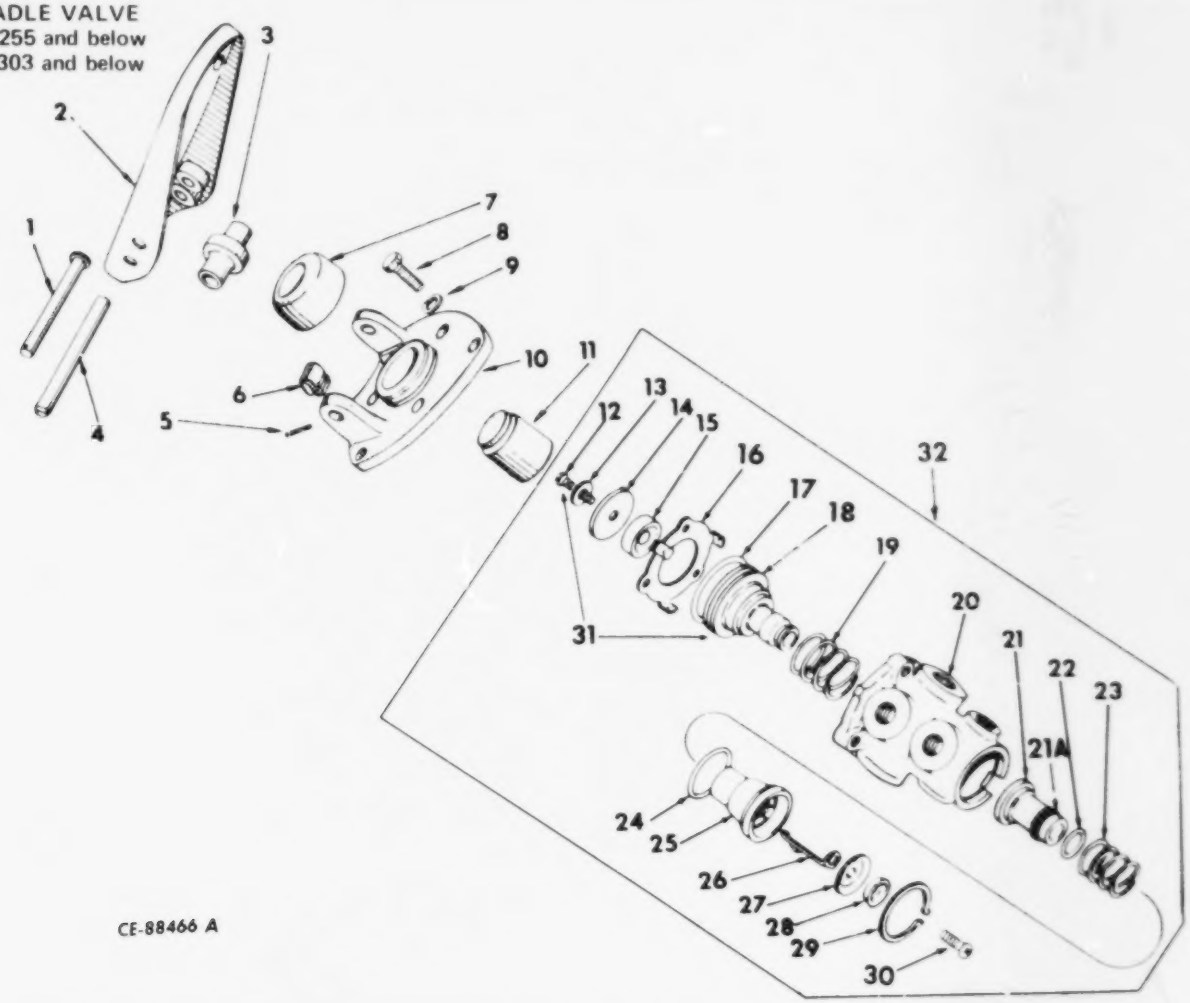
TREADLE VALVE
U001255 and below
C001303 and below




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 162 410 H3 | VALVE ASSEMBLY (Consists of the following) (2) |
| 1 | 303 134 R1 | PIN ROLLER |
| | 107 762 | PIN, 3/32 x 5/8" cotter |
| 2 | 303 133 R91 | TREADLE |
| 3 | 145 973 H1 | ROLLER |
| 4 | 178 171 H1 | PIN, fulcrum |
| 5 | 178 172 H1 | PIN, roll |
| 6 | 303 132 R1 | BUTTON, stop |
| 7 | 155 377 H1 | BOOT |
| 8 | 180 077 | BOLT, 5/16NC x 3/4" (3) |
| 9 | 103 320 | WASHER, 5/16" lock (3) |
| 10 | 303 131 R1 | PLATE, mounting |
| 11 | 179 900 R1 | PLUNGER |
| 12 | 236 182 R1 | SCREW, cap |
| 13 | 172 323 H1 | WASHER, lock |
| 14 | 172 322 H1 | SEAT, spring |
| 15 | 233 949 R1 | SPRING, rubber |
| 16 | 236 184 R1 | RETAINER, piston |
| 17 | 236 183 R1 | GROMMET, piston return |
| 18 | 172 320 H2 | PISTON |
| 19 | 145 958 H1 | SPRING, piston return |
| 20 | 172 304 H1 | BODY |
| 21 | 236 175 R1 | VALVE INLET & EXHAUST |
| 21A | 179 025 H1 | RETAINER, valve |
| 22 | 172 314 H1 | GROMMET, valve |
| 23 | 236 177 R1 | SPRING, valve |
| 24 | 172 311 H1 | GROMMET, exhaust valve |
| 25 | 303 572 C1 | SEAT, exhaust valve |
| 26 | 236 171 R1 | SPRING INLET VALVE |
| 27 | 236 172 R1 | DIAPHRAGM |
| 28 | 236 173 R1 | WASHER, diaphragm |
| 29 | 299 470 R1 | RING, retaining |
| 30 | 164 354 | SCREW, No. 8-32 x 3/8" pan hd. |
| | 348 192 C1 | FILTER VENT |
| 31 | | PISTON, complete (Order the following parts 1 PISTON 172 320 H2 1 SCREW 236 182 R1 ) |
| 32 | 178 964 H3 | VALVE BRAKE |
| | 44 576 | PLUG, pipe 1/4" (3) in Unused Ports |

| REF. NO. | PART NUMBER | DESCRIPTION | | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|---|
| TREADLE VALVE - Continued<br>U001255 and below<br>C001303 and below | | | | | | |
| 32 | 44 588 | PLUG, pipe 1/2" (6) In Brake Valves | | | | |
| | 178 170 H1 | KIT, treadle service | | | | |
| | | (Consists of - | | | | |
| | | 1 | PIN | 107 762 | | |
| | | 1 | PIN | 303 134 R1 | | |
| | | 1 | PIN | 178 171 H1 | | |
| | | 1 | PIN | 178 172 H1 | | |
| | | 1 | ROLLER | 145 973 H1 | | |
| | | 1 | TREADLE | 303 133 R91) | | |
| | 172 319 H1 | PISTON ASSEMBLY | | | | |
| | | (Composed of - | | | | |
| | | § 1 | PISTON | | | |
| | | 1 | RETAINER | 236 184 R1 | | |
| | | 1 | SCREW | 179 071 H2 | | |
| | | 1 | SEAT | 172 322 H1 | | |
| | | 1 | SPRING | 233 949 R1 ) | | |
| | 172 305 H1 | VALVE, inlet-exhaust | | | | |
| | | (Composed of - | | | | |
| | | 1 | DIAPHRAGM | 236 172 R1 | | |
| | | 1 | GROMMET | 172 311 H1 | | |
| | | 1 | GROMMET | 172 314 H1 | | |
| | | 1 | RETAINER | 179 025 H1 | | |
| | | 1 | SEAT | 303 572 C1 | | |
| | | 1 | SPRING | 236 171 R1 | | |
| | | 1 | SPRING | 236 177 R1 | | |
| | | 1 | VALVE | 236 175 R1 | | |
| | | 1 | WASHER | 236 173 R1) | | |

§ - Not furnished separately.



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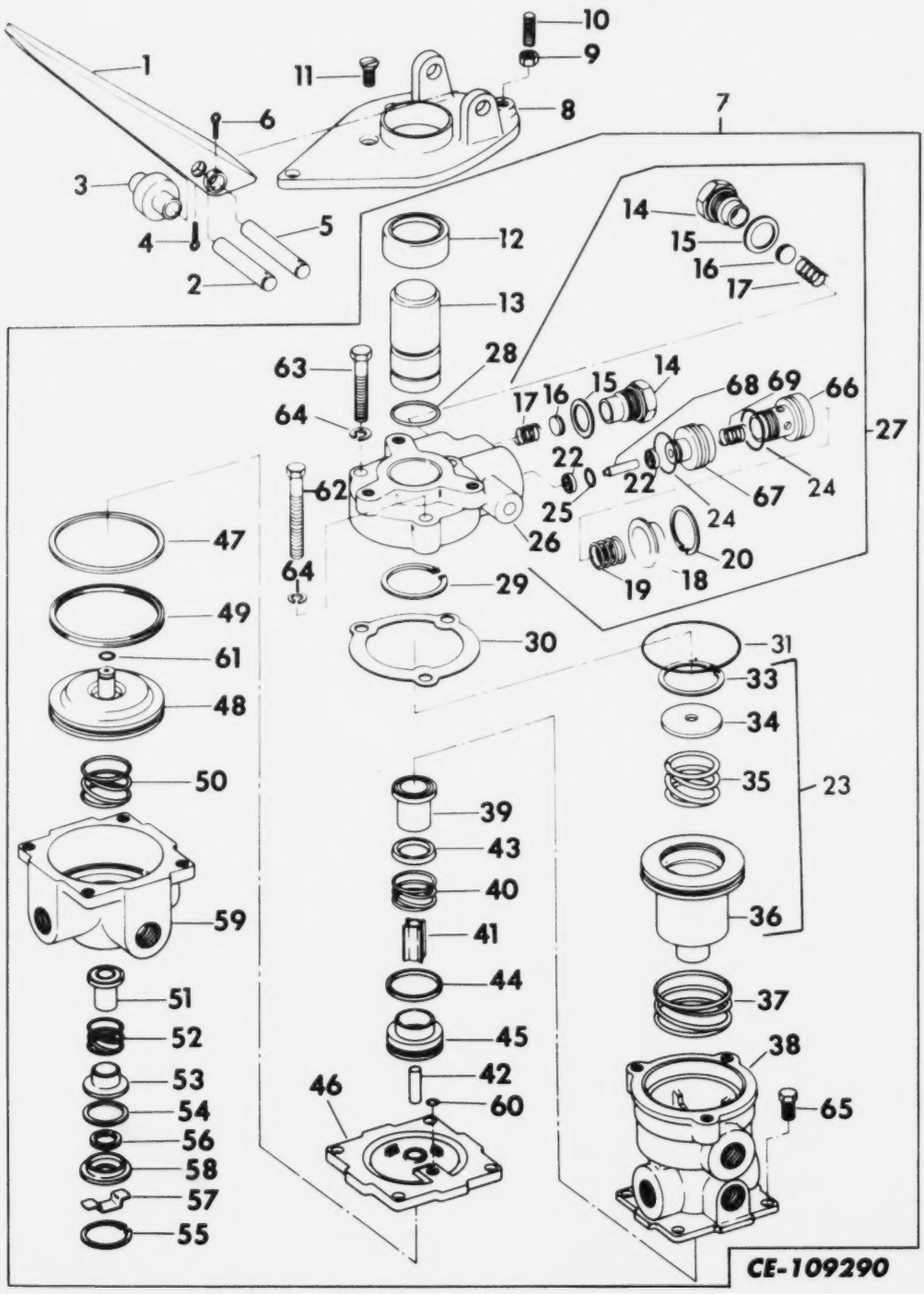
TREADLE VALVE - L.H.
U001256 and up
C001304 and up



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TREADLE VALVE - L.H. - Continued** |
| | | **U001256 and up** |
| | | **C001304 and up** |
| | | Parts without letters after the description indicates the part is used for all TREADLE VALVE ASSEMBLIES. Letters "A" and "B" are used to identify separate TREADLE VALVE ASSEMBLIES |
| A | 894 936 C91 | TREADLE VALVE ASSEMBLY (L.H.) (Order TREADLE VALVE ASSEMBLY,894 936 C92) |
| | 103 025 | NUT (3) |
| | 181 339 | SCREW, hex-hd cap (3) |
| | 103 320 | WASHER, lock (3) |
| B | 894 936 C92 | TREADLE VALVE ASSEMBLY (L.H.) |
| | 103 025 | NUT (3) |
| | 181 339 | SCREW, hex-hd cap (3) |
| | 103 320 | WASHER, lock (3) |
| | | Consists of the following parts. |
| 1 | 920 864 C1 | TREADLE |
| 2 | 165 741 H1 | PIN, treadle (++) |
| 3 | 219 115 H1 | ROLLER (++) |
| 4 | 108 636 | PIN, cotter (++) |
| 5 | | PIN, treadle (++) |
| 6 | 103 373 | PIN, cotter (++) |
| 7 | 920 848 C91 | TANDEMERGENCY VALVE ASSEMBLY (Order VALVE ASSEMBLY,920 848 C92) (A) |
| 7 | 920 848 C92 | TANDEMERGENCY VALVE ASSEMBLY (Consists of one MAINTENANCE KIT,941 097 C91, one SEAL KIT, 941 098 C91 and one VALVE ASSEMBLY, 920 854 C92) |
| 8 | 936 939 C1 | FLANGE, mounting |
| 9 | 25 519 R1 | NUT, hex-jam |
| 10 | 25 174 R1 | SCREW, hex-socket set |
| 11 | 133 827 | SCREW, flat-hd machine (3) |
| 12 | 165 746 H1 | BOOT (Not part of ASSEMBLY, 920 848 C91) (A) (%) |
| 12 | | BOOT (B) (##) |
| 13 | | PLUNGER (A) (++) |
| 13 | | PLUNGER (Not part of ASSEMBLY, 920 848 C92) (B) (++) |
| 14 | 920 861 C1 | CAP (A) (2) |
| 14 | | CAP (B) (Part of ASSEMBLY, 920 854 C92) (2) |
| 15 | 171 991 H1 | GASKET (A) (%) (2) |
| 15 | | GASKET (B) (##) |
| 16 | | VALVE (##) (%) (2) |
| 17 | | SPRING, valve (#) (+) (2) |
| 18 | 610 597 C1 | RETAINER, spring (A) |
| 18 | | RETAINER, spring (Part of ASSEMBLY, 920 854 C92) |
| 19 | | SPRING, piston (#) (+) |
| 20 | 211 343 R1 | RING, retaining (A) (%) |
| 20 | | RING, retaining (B) (##) |
| 22 | | VALVE & SEAT (##) (%) |
| 23 | | PISTON ASSEMBLY (#) (+) |
| 24 | 219 002 H1 | "O" RING (A) (%) (2) |
| 24 | | "O" RING (B) (##) (2) |

(#) - Part of KIT, 941 097 C91
(##) - Part of KIT, 941 098 C91
(++) - Part of KIT, 926 235 C91
(%) - Part of KIT, 926 223 C91
(+) - Part of KIT, 926 224 C91

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **TREADLE VALVE - L.H. - Continued** | | |
| **U001256 and up** | | |
| **C001304 and up** | | |
| 25 | 355 967 R1 | "O" RING (A) (%) |
| 25 | | "O" RING (B) (##) |
| 26 | | BODY, protection valve (Part of ASSEMBLY, 920 854 C92) |
| 27 | 920 854 C92 | PROTECTION VALVE ASSEMBLY |
| 28 | 350 818 R1 | "O" RING (A) (%) |
| 28 | | "O" RING (B) (##) |
| 29 | 866 189 R1 | RING, retaining (A) (%) |
| 29 | | RING, retaining (B) (##) |
| 30 | | GASKET (##) (%) |
| 31 | 21 056 R1 | "O" RING (A) (%) |
| 31 | | "O" RING (B) (##) |
| 32 | | NOT USED |
| 33 | 219 120 H1 | RING, retaining (A) (+) |
| 33 | | RING, retaining (B) (#) |
| 34 | 219 121 H1 | RETAINER, spring (A) (+) |
| 34 | | RETAINER, spring (B) (#) |
| 35 | 219 122 H1 | SPRING, metering (A) (+) |
| 35 | | SPRING, metering (B) (#) |
| 36 | | PISTON (#) (+) |
| 37 | 219 125 H1 | SPRING, primary return (A) (+) |
| 37 | | SPRING, primary return (B) (#) |
| 38 | | BODY, primary (Part of ASSEMBLY, 920 848 C92) |
| 39 | 219 017 H1 | VALVE, primary inlet (A) (%) |
| 39 | | VALVE, primary inlet (B) (##) |
| 40 | 219 016 H1 | SPRING, primary inlet (B) (#) |
| 40 | | SPRING, primary inlet (B) (#) |
| 41 | 891 629 C1 | GUIDE, push rod (A) (+) |
| 41 | | GUIDE, push rod (B) (#) |
| 42 | 891 627 C1 | ROD, push (A) (+) |
| 42 | | ROD, push (B) (#) |
| 43 | 219 015 H1 | PACKING, vee block (A) (%) |
| 43 | | RING, quad (B) (##) |
| 44 | 219 014 H1 | TETRASEAL (A) (%) |
| 44 | | TETRASEAL (B) (#) |
| 45 | 610 605 C1 | GUIDE, valve (A) (+) |
| 45 | | GUIDE, valve (B) (#) |
| 46 | 219 127 H1 | COVER (A) |
| 46 | | COVER, (Part of ASSEMBLY, 920 848 C92) (B) |
| 47 | 219 128 H1 | TETRASEAL (A) (%) |
| 47 | | TETRASEAL (B) (##) |
| 48 | 219 129 H1 | PISTON, secondary (A) (+) |
| 48 | | PISTON, secondary (B) (#) |
| 49 | 891 628 C1 | RING, quad (A) (%) |
| 49 | | RING, quad (B) (#) |
| 50 | 219 133 H1 | SPRING, secondary return (A) (+) |
| 50 | | SPRING, secondary return (B) (#) |
| 51 | 219 140 H1 | VALVE, secondary inlet (A) (%) |

(##) - Part of KIT, 941 098 C91
(%) - Part of KIT, 926 223 C91
(#) - Part of KIT, 941 097 C91
(+) - Part of KIT, 926 224 C91

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **TREADLE VALVE - L.H. - Continued** | | |
| **U001256 and up** | | |
| **C001304 and up** | | |
| 51 | | VALVE, secondary inlet (B) (##) |
| 52 | 219 139 H1 | SPRING, secondary inlet (A) (+) |
| 52 | | SPRING, secondary inlet (B) (#) |
| 53 | 219 138 H1 | GUIDE, valve (A) (+) |
| 53 | | GUIDE, valve (B) (#) |
| 54 | 219 137 H1 | TETRASEAL (A) (%) |
| 54 | | TETRASEAL (B) (##) |
| 55 | 219 132 H1 | RING, retaining (A) (%) |
| 55 | | RING, retaining (B) (##) |
| 56 | 920 853 | RING, quad (A) (%) |
| 56 | 920 853 C1 | RING, quad (B) (##) |
| 57 | 219 134 H1 | SHIELD, exhaust (A) (+) |
| 57 | | SHIELD, exhaust (B) (#) |
| 58 | 920 852 C1 | RETAINER, seal (A) (+) |
| 58 | | RETAINER, seal (B) (#) |
| 59 | | BODY, secondary (Part of ASSEMBLY 920 848 C92) |
| 60 | 360 599 R1 | "O" RING (A) (%) |
| 60 | | "O" RING (B) (##) |
| 61 | 352 219 R1 | "O" RING (A) (%) |
| 61 | | "O" RING (B) (##) |
| 62 | 25 750 R1 | BOLT, hex-hd cap (2) |
| 63 | 25 493 R1 | BOLT, hex-hd cap |
| 64 | 120 214 | WASHER, lock (3) |
| 65 | 25 162 R1 | SCREW (4) |
| | | WASHER, lock (4) |
| 66 | | BODY, piston (Part of ASSEMBLY, 920 854 C92) |
| 67 | | BODY, piston (Part of ASSEMBLY, 920 854 C92) |
| 68 | | PISTON (Part of ASSEMBLY 920 854 C92) |
| 69 | | SPRING, valve (##) (%) |
| | 920 849 C1 | DUAL AIR VALVE ASSEMBLY (A) (Consists of - |
| | | § 1 BODY |
| | | § 1 BODY |
| | | 1 COVER 219 127 H1 |
| | | 1 GUIDE, push rod 891 629 C1 |
| | | 1 GUIDE, valve 219 138 H1 |
| | | 1 GUIDE, valve 610 605 C1 |
| | | 1 "O" RING 21 056 R1 |
| | | 1 "O" RING 352 219 R1 |
| | | 1 "O" RING 360 559 R1 |
| | | 1 PACKING, vee block 219 015 H1 |
| | | § 1 PISTON ASSEMBLY |
| | | 1 PISTON 219 129 H1 |
| | | 1 RETAINER, seal 920 852 C1 |
| | | 1 RETAINER, spring 219 121 H1 |
| | | 1 RING, retaining 219 132 H1 |
| | | 1 RING, quad 891 628 C1 |
| | | 1 RING, quad 920 853 C1 |
| | | 1 ROD, push 891 627 C1 |
| | | 4 SCREW & WASHER, lock 25 162 R1 |
| | | 1 SHIELD, exhaust 357 878 C1 |
| | | 1 SPRING, primary inlet 219 016 H1 |
| | | 1 SPRING, primary return 219 125 H1 |
| | | 1 SPRING, secondary inlet 219 139 H1 |

§ - Not furnished separately.

(#) - Part of KIT, 941 097 C91
(##) - Part of KIT, 941 098 C91
(+) - Part of KIT, 926 224 C91
(%) - Part of KIT, 926 223 C91
§ - Not Serviced Separately

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | TREADLE VALVE - L.H. - Continued |
| | | U001256 and up |
| | | C001304 and up |
| 920 849 C1 | | DUAL AIR VALVE ASSEMBLY (A) |
| | | (Consists of - Continued |
| | | 1 SPRING, secondary return 219 133 H1 |
| | | 1 TETRASEAL 219 014 H1 |
| | | 1 TETRASEAL 219 128 H1 |
| | | 1 TETRASEAL 219 137 H1 |
| | | 1 VALVE, primary inlet 219 017 C1 |
| | | 1 VALVE, secondary inlet 219 140 H1 ) |
| 926 224 C91 | | KIT, maintenance (For Tandemergency Valve) (A) |
| | | (Consists of - |
| | | 1 GUIDE, push rod 891 629 C1 |
| | | 1 GUIDE, valve 219 138 H1 |
| | | 1 GUIDE, valve 610 605 C1 |
| | | § 1 PISTON ASSEMBLY |
| | | § 1 PISTON, metering |
| | | 1 PISTON, secondary 219 129 H1 |
| | | 1 RETAINER, seal 920 852 C1 |
| | | 1 RETAINER, spring 219 121 H1 |
| | | 1 RING, retaining 219 120 H1 |
| | | 1 ROD, push 891 627 C1 |
| | | 1 SHIELD, exhaust 357 878 C1 |
| | | § 2 SPRING, check valve |
| | | § 1 SPRING, emergency piston |
| | | 1 SPRING, metering 219 122 H1 |
| | | 1 SPRING, primary inlet 219 016 H1 |
| | | 1 SPRING, primary return 219 125 H1 |
| | | 1 SPRING, secondary inlet 219 139 H1 |
| | | 1 SPRING, secondary return 219 133 H1) |
| 926 235 C91 | | KIT, maintenance (For Treadle) |
| | | (Consists of - |
| | | 1 PIN, cotter 103 323 |
| | | 1 PIN, cotter 108 636 |
| | | 1 PIN, treadle 165 741 H1 |
| | | § 1 PIN, treadle |
| | | § 1 PLUNGER |
| | | 1 ROLLER 219 115 H1 ) |
| 941 097 C91 | | KIT, maintenance (For Tandemergency Valve) (B) |
| | | (Consists of - |
| | | § 1 GUIDE, push rod |
| | | § 1 GUIDE, valve |
| | | § 1 GUIDE, valve |
| | | § 1 PISTON ASSEMBLY |
| | | § 1 PISTON, metering |
| | | § 1 PISTON, secondary |
| | | § 1 RETAINER, seal |
| | | § 1 RETAINER, spring |
| | | § 1 RING, retaining |
| | | § 1 ROD, push |
| | | § 1 SHIELD, exhaust |
| | | § 2 SPRING, check valve |
| | | § 1 SPRING, emergency piston |
| | | § 1 SPRING, metering |
| | | § 1 SPRING, primary inlet |
| | | § 1 SPRING, primary return |
| | | § 1 SPRING, secondary inlet |
| | | § 1 SPRING, secondary return ) |
| 926 223 C91 | | KIT, seal (For Tandemergency Valve) (A) |
| | | (Consists of - |
| | | 1 BOOT 165 746 H1 |
| | | 2 GASKET 171 991 H1 |
| | | § 1 GASKET |
| | | 1 "O" RING 21 056 R1 |
| | | 1 "O" RING 219 002 H1 |
| | | 1 "O" RING 350 818 R1 |
| | | 1 "O" RING 352 219 R1 |
| | | 1 "O" RING 355 967 R1 |
| | | 1 "O" RING 360 559 R1 |
| | | § 1 PISTON |
| | | § 1 PISTON & SHUTTLE VALVE |
| | | 1 RING, retaining 211 343 H1 |
| | | 1 RING, retaining 219 132 H1 |
| | | 1 RING, retaining 866 189 R1 |
| | | 1 RING, quad 891 628 C1 |
| | | 1 RING, quad 920 853 C1 |
| | | 1 TETRASEAL 219 014 H1 |
| | | 1 TETRASEAL 219 128 H1 |
| | | 1 TETRASEAL 219 137 H1 |
| | | § 2 VALVE |
| | | § 2 VALVE & SEAT |
| | | 1 VALVE, primary inlet 219 017 H1 |
| | | 1 VALVE, secondary inlet 219 140 H1) |

§ - Not furnished separately.



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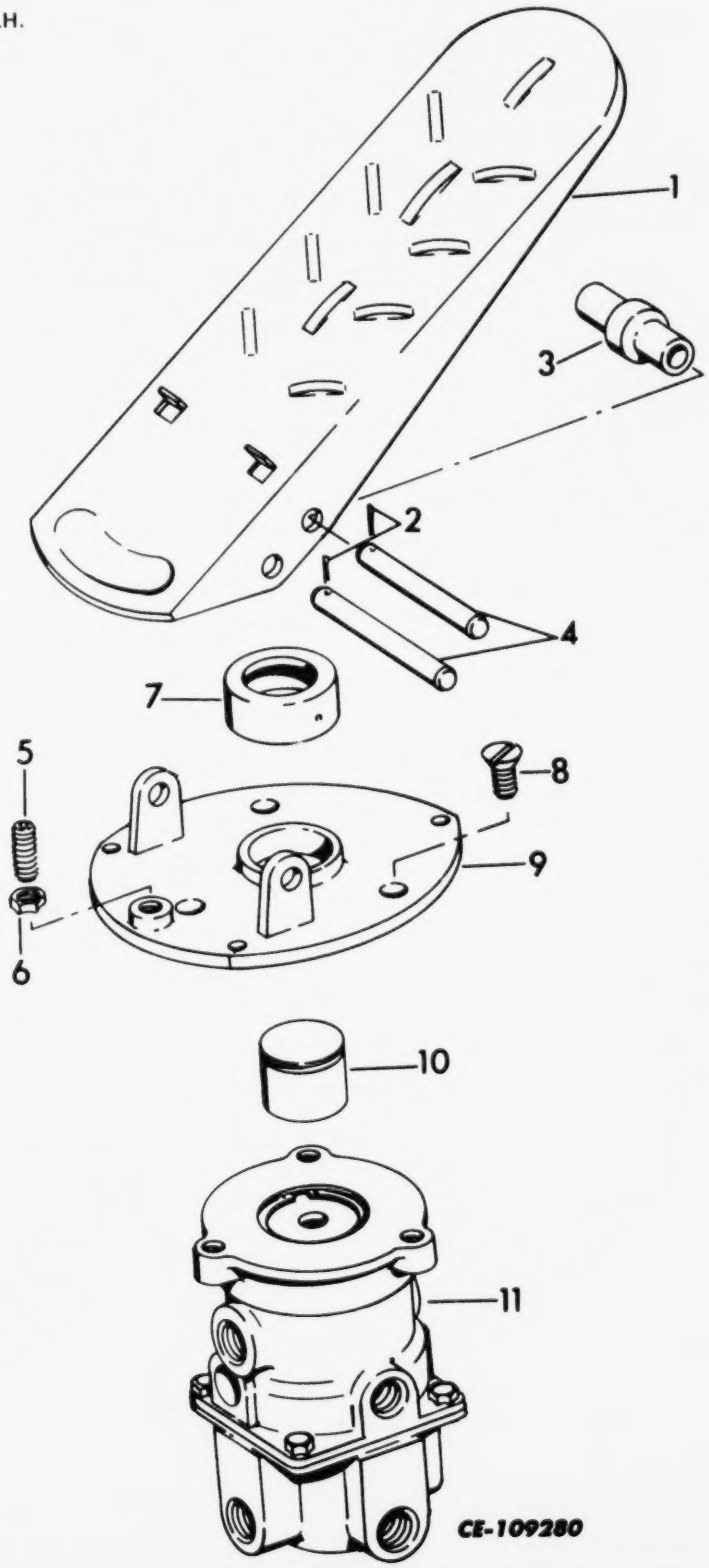
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

TREADLE VALVE - L.H. - Continued
U001256 and up
C001304 and up

941 098 C91 KIT, seal (For Tandemergency Valve)
(B)
(Consists of -
§ 1 BOOT
§ 2 GASKET
§ 1 GASKET
§ 1 "O" RING
§ 1 "O" RING
§ 1 "O" RING
§ 1 "O" RING
§ 1 "O" RING
§ 1 "O" RING
§ 1 PISTON
§ 1 PISTON & SHUTTLE VALVE
§ 1 RING, retaining
§ 1 RING, retaining
§ 1 RING, retaining
§ 1 RING, quad
§ 1 RING, quad
§ 1 RING, quad
§ TETRASEAL
§ TETRASEAL
§ TETRASEAL
§ 2 VALVE
§ 1 VALVE, primary inlet
§ 1 VALVE, secondary inlet )

§ - Not furnished separately.

TREADLE VALVE - R.H.
U001256 and up
C001304 and up



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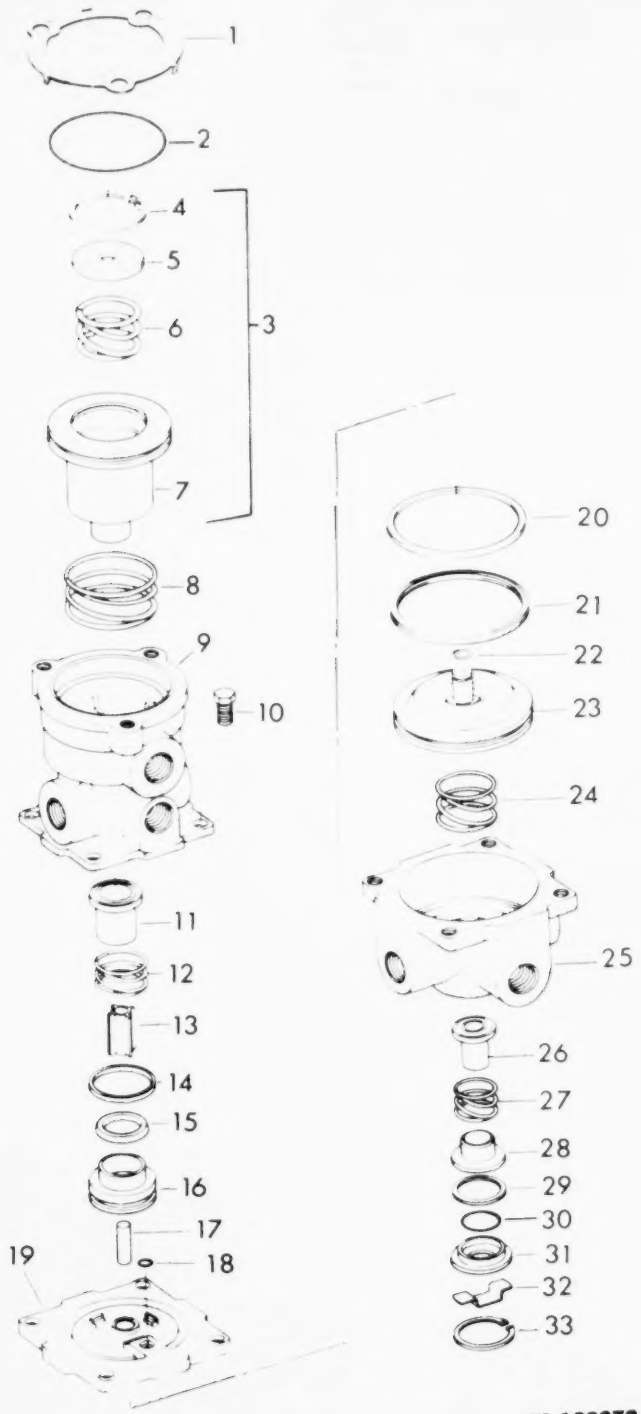
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TREADLE VALVE - R.H. - Continued** |
| | | **U001256 and up** |
| | | **C001304 and up** |
| | | Parts without letters after the description indicates the part is used for all TREADLE VALVE ASSEMBLIES. Letters "A" and "B" are used to identify separate TREADLE VALVE ASSEMBLIES |
| A | 215 320 H1 | TREADLE VALVE ASSEMBLY (Order TREADLE VALVE ASSEMBLY, 215 320 H2) |
| B | 215 320 H2 | TREADLE VALVE ASSEMBLY |
| | 103 025 | NUT (3) |
| | 181 339 | SCREW, hex-hd cap (3) |
| | 103 320 | WASHER, lock (3) |
| 1 | 219 112 H1 | TREADLE |
| 2 | 108 636 | PIN, cotter (A) (2) |
| 2 | | PIN, cotter (B) (+) (2) |
| 3 | 219 115 H1 | ROLLER (A) |
| 3 | | ROLLER (B) (+) |
| 4 | 165 741 H1 | PIN, treadle (A) (2) |
| 4 | | PIN, treadle (B) (+) (2) |
| 5 | 102 575 | SCREW, hex-socket hd set |
| 6 | 25 519 R1 | NUT, jam |
| 7 | 165 746 H1 | BOOT, plunger (A) (%) |
| 7 | | BOOT, plunger (B) (++) |
| 8 | 156 454 | SCREW, flat hd-machine (3) |
| 9 | 936 939 C1 | FLANGE, mounting |
| 10 | 219 114 H1 | PLUNGER (A) |
| 10 | | PLUNGER (B) (+) |
| 11 | | VALVE ASSEMBLY, basic (Refer to BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H.) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 941 464 C91 | KIT, maintenance (B) (Consists of - § 2 PIN, cotter § 2 PIN, treadle § 1 PLUNGER § 1 ROLLER ) |

(§) - Not furnished separately.
(+) - Part of KIT, 941 464 C91
(++) - Part of KIT, 941 277 C91 (Refer to BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H.)
(%) - Also part of KIT, 219 117 H1 (Refer to BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H.)

BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H.
U001256 and up
C001304 and up

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BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H. - Continued
U001256 and up
C001304 and up

Parts without letters after the description indicates the part is used for all TREADLE VALVE ASSEMBLIES. Letters "A" and "B" are used to identify separate TREADLE VALVE ASSEMBLIES.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 219 111 H1 | VALVE ASSEMBLY, basic (Order VALVE ASSEMBLY, 219 111 H2) (R.H.) |
| B | 219 111 H2 | VALVE ASSEMBLY, basic (R.H.) |
| 1 | 219 118 H1 | RETAINER, spring |
| 2 | 21 056 R1 | "O" RING (A) (%) |
| 2 | | "O" RING (B) (+) |
| 3 | 219 119 H1 | PISTON ASSEMBLY (A) |
| 3 | | PISTON ASSEMBLY (B) (++) |
| 4 | 219 120 H1 | RING, retaining (A) |
| 4 | | RING, retaining (B) (++) |
| 5 | 219 121 H1 | RETAINER, spring (A) |
| 5 | | RETAINER, spring (B) (++) |
| 6 | 219 122 H1 | SPRING, metering (A) |
| 6 | | SPRING, metering (B) (++) |
| 7 | 219 123 H1 | PISTON (A) |
| 7 | | PISTON (B) (++) |
| 8 | 219 125 H1 | SPRING, return (A) |
| 8 | | SPRING, return (B) (++) |
| 9 | | BODY, primary (Not furnished separately) |
| 10 | 179 796<br>103 319 | SCREW, hex-hd cap (4)<br>WASHER, lock (4) |
| 11 | 219 017 H1 | VALVE, inlet (A) (%) |
| 11 | | VALVE, inlet (B) (+) |
| 12 | 219 016 H1 | SPRING, inlet valve (A) |
| 12 | | SPRING, inlet valve (B) (++) |
| 13 | 891 629 C1 | GUIDE, push rod (A) (%) |
| 13 | | GUIDE, push rod (B) (++) |
| 14 | | TETRASEAL (+) |
| 15 | 219 015 H1 | PACKING, vee block (A) (%) |
| 15 | | RING, quad (B) (+) |
| 16 | 610 605 C1 | GUIDE, valve (A) |
| 16 | | GUIDE, valve (B) (++) |
| 17 | 891 627 C1 | ROD, push (A) (%) |
| 17 | | ROD, push (B) (++) |
| 18 | 360 599 R1 | "O" RING (A) (%) |
| 18 | | "O" RING (B) (+) |
| 19 | 219 127 H1 | COVER (A) |
| 19 | | COVER (Not furnished separately) |
| 20 | 219 128 H1 | TETRASEAL (A) (%) |
| 20 | | TETRASEAL (B) (+) |
| 21 | 891 628 C1 | RING, quad (A) (%) |
| 21 | | RING, quad (B) (+) |
| 22 | 219 130 H1 | "O" RING (A) (%) |
| 22 | | "O" RING (B) (+) |
| 23 | 219 129 H1 | PISTON, secondary (A) |
| 23 | | PISTON, secondary (B) (++) |
| 24 | 219 133 H1 | SPRING, return (A) |
| 24 | | SPRING, return (B) (++) |
| 25 | | BODY, secondary (Not furnished separately) |

(%) - Part of KIT, 219 117 H1
(+) - Part of KIT, 941 277 C91
(++) - Part of KIT, 941 278 C91

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H. - Continued
U001256 and up
C001304 and up

| | | |
|---|---|---|
| 26 | 219 140 H1 | VALVE, inlet (A) (%) |
| 26 | | VALVE, inlet (B) (+) |
| 27 | 219 139 H1 | SPRING, inlet (A) |
| 27 | | SPRING, inlet (B) (++) |
| 28 | 219 138 H1 | GUIDE, valve (A) |
| 28 | | GUIDE, valve (B) (++) |
| 29 | 219 137 H1 | TETRASEAL (A) (%) |
| 29 | | TETRASEAL (B) (+) |
| 30 | 920 853 C1 | RING, quad (A) (%) |
| 30 | | RING, quad (B) (+) |
| 31 | 920 852 C1 | RETAINER, seal (A) (%) |
| 31 | | RETAINER, seal (B) (++) |
| 32 | 357 878 C1 | SHIELD, exhaust (A) |
| 32 | | SHIELD, exhaust (B) (++) |
| 33 | 219 132 H1 | RING, retaining (A) |
| 33 | | RING, retaining (B) (+) |

941 278 C91 KIT, maintenance (For Dual Application Valve) (B)
(Consists of -
§ 1 GUIDE, push rod
§ 1 GUIDE, valve
§ 1 GUIDE, valve
§ 1 PISTON ASSEMBLY
§ 1 PISTON, metering
§ 1 PISTON, secondary
§ 1 RETAINER, seal
§ 1 RETAINER, spring
§ 1 RING, retaining
§ 1 ROD, push
§ 1 SHIELD, exhaust
§ 1 SPRING, metering
§ 1 SPRING, primary inlet
§ 1 SPRING, primary return
§ 1 SPRING, secondary inlet
§ 1 SPRING, secondary return)

941 277 C91 KIT, seal (For Dual Application Valve) (B)
(Consists of -
§ 1 BOOT
§ 1 "O" RING
§ 1 "O" RING
§ 1 "O" RING
§ 1 RING, quad
§ 1 RING, quad
§ 1 RING, quad
§ 1 RING, retaining
§ 1 TETRASEAL
§ 1 TETRASEAL
§ 1 TETRASEAL
§ 1 VALVE, primary inlet
§ 1 VALVE, secondary inlet)

219 117 H1 KIT, valve repair (A)
(Consists of -

| | |
|---|---|
| 1 BOOT | 165 746 H1 |
| 1 GUIDE, push rod | 891 629 C1 |
| 1 "O" RING | 21 056 R1 |
| 1 "O" RING | 219 130 H1 |
| 1 "O" RING | 360 599 R1 |
| 1 PACKING, vee block | 219 015 H1 |
| 1 RING, quad | 891 628 C1 |
| 1 RING, quad | 920 853 C1 |
| 1 RETAINER, seal | 920 852 C1 |
| 1 ROD, push | 891 627 C1 |
| 1 TETRASEAL | 219 128 H1 |
| 1 TETRASEAL | 219 137 H1 |
| 1 VALVE, primary inlet | 219 017 H1 |
| 1 VALVE, secondary inlet | 219 140 H1) |

(§) - Not furnished separately
(+) - Part of KIT, 941 464 C91
(++) - Part of KIT, 941 277 C91 (Refer to BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H.)
(%) - Also part of KIT, 219 117 H1 (Refer to BASIC VALVE ASSEMBLY - TREADLE VALVE - R.H.)


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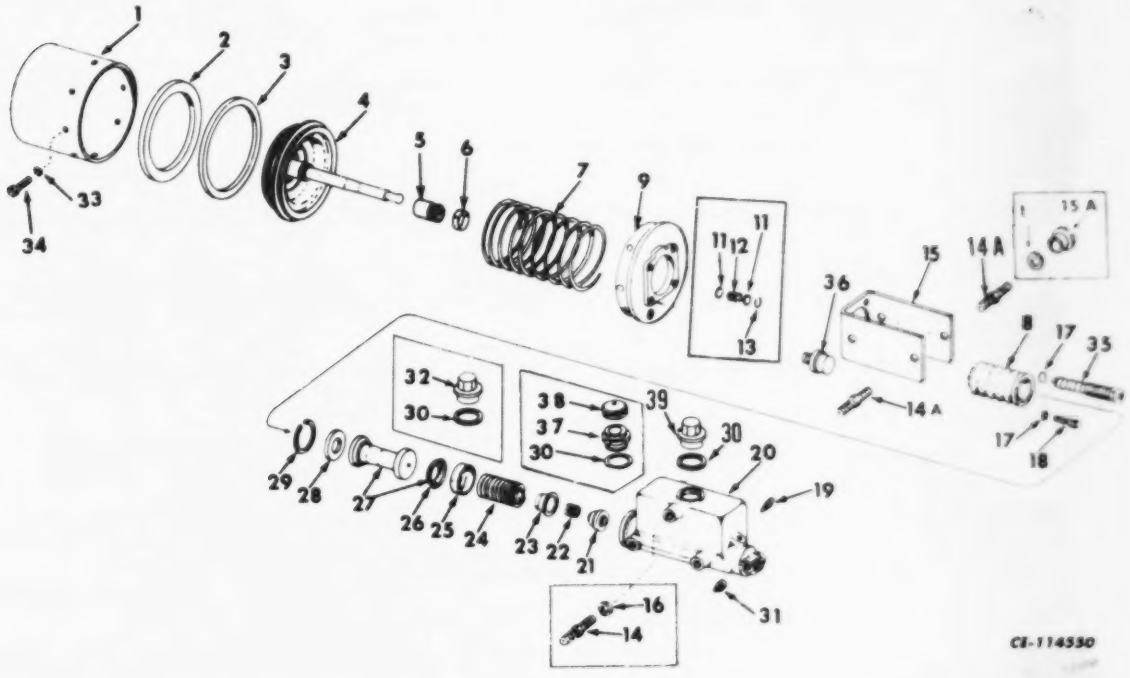
POWER CLUSTER




Parts without letters after the description indicate the part is used for all Power Cluster Assemblies listed below. Letters "A", "B" and "C" are used to identify separate Power Cluster Assemblies.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 184 003 H2 | POWER CLUSTER ASSEMBLY (AF-49810A) (4) * and below (Order POWER CLUSTER, 184 003 H4) |
| B | 184 003 H3 | POWER CLUSTER ASSEMBLY (AF-49810C) (4) * thru * (Order POWER CLUSTER, 184 003 H4) |
| C | 184 003 H4 | POWER CLUSTER ASSEMBLY (AF-49810J) (4) * and up |
| 1 | 169 032 H1 | SHELL |
| 2 | 165 716 H1 | CUP, air cylinder piston (+) (%%) |
| 3 | 165 718 H1 | WIPER (+) (%%) |
| 4 | 169 033 H1 | PISTON w/ROD |
| 5 | 347 324 R1 | GROMMET |
| 6 | 145 949 H1 | STRAP, boot |
| 7 | 169 035 H1 | SPRING, piston return |
| 8 | 211 736 H1 | BOOT (+) (%%) |
| 9 | 211 738 H1 | HEAD w/FILTER, 347 548 R1, RETAINER, 347 547 R1 and two SCREEN, 165 722 H1, cylinder (Assembly A) |
| 9 | | HEAD, cylinder (Not furnished separately) (Assembly B and C) |
| 11 | 165 722 H1 | SCREEN, filter (Assembly A) (2) |
| 12 | 347 548 R1 | FILTER (Assembly A) |
| 13 | 347 547 R1 | RETAINER (Assembly A) |
| 14 | 184 828 R1 | STUD, mounting (Assembly A and B |
| 14A | 184 828 R1 | STUD, mounting (Assembly A and B (2) |
| 14A | 184 828 R1 | STUD, mounting (Assembly C) (4) |

* Serial Number not available.
(+) Part of KIT, 704 702 C91
(%%) Part of KIT, 1 106 823 C91

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| POWER CLUSTER - Continued | | |
| 15 | 347 323 R1 | SUPPORT, cylinder |
| 15A | 181 394 | BOLT, 7/16"NF x 7/8" (Assembly A and B) (2) |
| 15B | 103 327 | WASHER, 7/16" lock (Assembly A) (2) |
| 15B | 103 322 | WASHER, 7/16" lock (Assembly B) (2) |
| 16 | 184 827 H1 | SPACER, mounting plate (Assembly A and B) |
| 17 | 120 382 | WASHER, lock (3) |
| 18 | 24 840 R1 | BOLT (3) |
| 19 | 102 384 H1 | SCREW, cylinder bleeder (Assembly A and B) |
| 19 | | SCREW, cylinder bleeder (Order ASSEMBLY, 1 106 821 C91) (Assembly C) |
| 20 | | HOUSING (Not furnished separately) |
| 21 | 165 732 H1 | VALVE (Assembly A and B) (+) (%) |
| 21 | | VALVE (Order KIT, 1 106 822 C1) (Assembly C) |
| 22 | 165 788 H1 | SPRING, check valve retainer |
| 22 | | SPRING, retainer (Order KIT, 1 106 822 C1) (Assembly C) |
| 23 | 165 787 H1 | RETAINER, check valve (Assembly A and B) |
| 23 | | SEAT, valve (Order KIT, 1 106 822 C1) (Assembly C) |
| 24 | 145 895 H1 | SPRING, piston return (Assembly A and B) |
| 24 | | SPRING, piston return (Order ASSEMBLY, 1 106 821 C91) (Assembly C) |
| 25 | | CUP, piston primary (Assembly A and B w/Master Cylinder, 926 786 C1) (Not furnished separately) (+) (%) |
| 25 | | CUP, piston primary (Not furnished separately) (Assembly B w/Master Cylinder, 338 428 R91) (+) (%) |
| 25 | | CUP, piston primary (Order KIT, 1 106 822 C1) (Assembly C) |
| 26 | 68 347 H | CUP, piston secondary (Assembly A and B) (%) |
| 26 | | CUP, piston secondary (Order KIT, 1 106 822 C1) (Assembly C) |
| 27 | 145 944 H1 | PISTON w/CUP, 68 347 H (Assembly A and B w/Master Cylinder, 926 786 C1) (+) (%) |
| 27 | | PISTON w/CUP (Not furnished separately) (Assembly B w/Master Cylinder, 338 428 R91) (+) (%) |
| 27 | | PISTON w/CUP (Order KIT, 1 106 822 C1) (Assembly C) |
| 28 | 169 041 H1 | PLATE, piston stop (Assembly A and B) |
| 28 | | PLATE, piston stop (Order ASSEMBLY, 1 106 821 C91) (Assembly C) |
| 29 | 169 040 H1 | RING, lock (Assembly A and B) (+) (%) |
| 29 | | RING, retaining (Order KIT, 1 106 822 C1) (Assembly C) |
| 30 | 92 148 H | GASKET, cap (Assembly A and B w/Master Cylinder, 926 786 C1) |
| 30 | 104 213 R1 | GASKET, filler cap (Assembly B w/ Master Cylinder, 338 428 R91) |
| 30 | | GASKET, filler cap (Order ASSEMBLY, 1 106 821 C91) (Assembly C) |
| 31 | 445 684 | PLUG, 1/8" drain (Assembly A and B w/Master Cylinder, 926 786 C1) |
| 31 | 103 877 | PLUG, 1/8" sq-hd pipe plug (Assembly B w/Master Cylinder, 338 428 R91) |
| 31 | | PLUG (Order ASSEMBLY, 1 106 821 C91) (Assembly C) |
| 32 | 92 145 HBX | CAP, filler (Assembly A) |
| 33 | 115 548 | WASHER, 5/16" lock (8) |
| 34 | 21 191 R1 | BOLT, 5/16 x 5/8" (Assembly A) (8) |
| 34 | 446 904 | BOLT, 5/16-18 x 5/8" (Assembly B and C) (8) |
| 35 | 169 037 H2 | INDICATOR, stroke (Replaces 338 425 R91) (Assembly B and C) |
| 36 | 926 782 C1 | BREATHER, filter (Assembly B) |
| 37 | 338 487 R1 | ADAPTER, filter cap (Assembly B w/Master Cylinder, 338 428 R91) |

(+) - Part of KIT, 704 702 C91.
(%) - Part of KIT, 704 680 C91.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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| POWER CLUSTER - Continued | | |
| 38 | 625 416 C1 | CAP, filler (Assembly B) |
| 39 | | CAP, filler (Order ASSEMBLY, 1 106 821 C91) (Assembly C) |
| | 49 034 H | GASKET, plug – For unused ports of power cluster (Not part of Assembly A or B) |
| | 49 035 H | PLUG, in unused ports of power cluster (Not part of Assembly A or B) |
| | 924 782 C91 | MASTER CYLINDER ASSEMBLY (FF1701) (Assembly A) (Order MASTER CYLINDER, 338 428 R91) (Composed of - |
| | | 1 CAP 92 145 HBX |
| | | § 1 CUP |
| | | 1 GASKET 92 148 H |
| | | § 1 HOUSING |
| | | 1 PISTON ASSY 145 944 H1 |
| | | 1 PLATE 169 041 H1 |
| | | 1 PLUG 445 684 |
| | | 1 RETAINER 165 787 H1 |
| | | 1 SCREW 102 384 H1 |
| | | 1 SPRING 145 895 H1 |
| | | 1 SPRING 165 778 H1 |
| | | 1 VALVE & SEAT 165 732 H1 |
| | | 1 WIRE 169 040 H1 ) |
| | 926 786 C1 | MASTER CYLINDER ASSEMBLY (FF2192) (assembly B) * and below (Order MASTER CYLINDER, 338 428 R91) (Composed of - |
| | | 1 CAP 625 416 C1 |
| | | § 1 CUP |
| | | 1 GASKET 92 148 H |
| | | § 1 HOUSING |
| | | 1 PISTON ASSY 145 944 H1 |
| | | 1 PLATE 169 041 H1 |
| | | 1 PLUG 445 684 |
| | | 1 RETAINER 165 787 H1 |
| | | 1 SCREW 102 384 H1 |
| | | 1 SPRING 145 895 H1 |
| | | 1 SPRING 165 788 H1 |
| | | 1 VALVE & SEAT 165 732 H1 |
| | | 1 WIRE 169 040 H1 ) |
| | 211 733 H1 | AIR CYLINDER ASSEMBLY (Assembly A) (Consists of - |
| | | 3 BOLT 24 840 R1 |
| | | 8 BOLT 446 904 |
| | | 1 CUP 165 716 H1 |
| | | 1 HEAD ASSY 211 738 H1 |
| | | 1 ROD 169 033 H1 |
| | | 1 SHELL 169 032 H1 |
| | | 1 SPRING 169 035 H1 |
| | | 4 WASHER 120 382 |
| | | 8 WASHER 115 548 |
| | | 1 WIPER 165 718 H1 ) (Order CYLINDER, 926 785 C91) |
| | 926 785 C91 | AIR CYLINDER ASSEMBLY (Assembly B and C) (Consists of - |
| | | 3 BOLT 24 840 R1 |
| | | 8 BOLT 446 904 |
| | | 1 CUP 165 716 H1 |
| | | § 1 HEAD |
| | | 1 INDICATOR 169 037 H2 |
| | | 1 ROD 169 033 H1 |
| | | 1 SHELL 169 032 H1 |
| | | 1 SPRING 169 035 H1 |
| | | 3 WASHER 120 382 |
| | | 8 WASHER 115 548 |
| | | 1 WIPER 165 718 H1 ) |
| | 338 428 R91 | MASTER CYLINDER ASSEMBLY (FF2190) (Assembly B) * and up (Composed of - |
| | | 1 ADAPTER 338 487 R1 |
| | | 1 CAP 625 416 C1 |
| | | 1 CUP 68 347 H |
| | | 1 GASKET 104 213 R1 |
| | | § 1 HOUSING |
| | | 1 PLATE 169 041 H1 |
| | | 1 PLUG 103 877 |
| | | 1 RETAINER 165 787 H1 |
| | | 1 RING 169 040 H1 |
| | | 1 SCREW 102 384 H1 |
| | | 1 SPRING 165 788 H1 |
| | | 1 SPRING 145 895 H1 |
| | 1 106 821 C91 | MASTER CYLINDER ASSEMBLY (Assembly C) (Consists of - |
| | | § 1 CAP |
| | | § 1 CUP |
| | | § 1 GASKET |
| | | § 1 HOUSING |
| | | 1 KIT 1 106 822 C1 |
| | | § 1 PISTON |
| | | § 1 PLATE |
| | | § 1 PLUG |
| | | § 1 SCREW |
| | | § 1 SEAT |
| | | § 1 SPRING |
| | 1 106 822 C1 | KIT, master cylinder repair (Assembly C) (Consists of - |
| | | § 1 CUP |
| | | § 1 GASKET |
| | | § 1 PISTON |
| | | § 1 RING |
| | | § 1 SEAT |
| | | § 1 SPRING |
| | | § 1 VALVE |

§ - Not Furnished Separately.
(+) - Part of KIT, 704 702 C91.
(%) - Part of KIT, 704 680 C91.

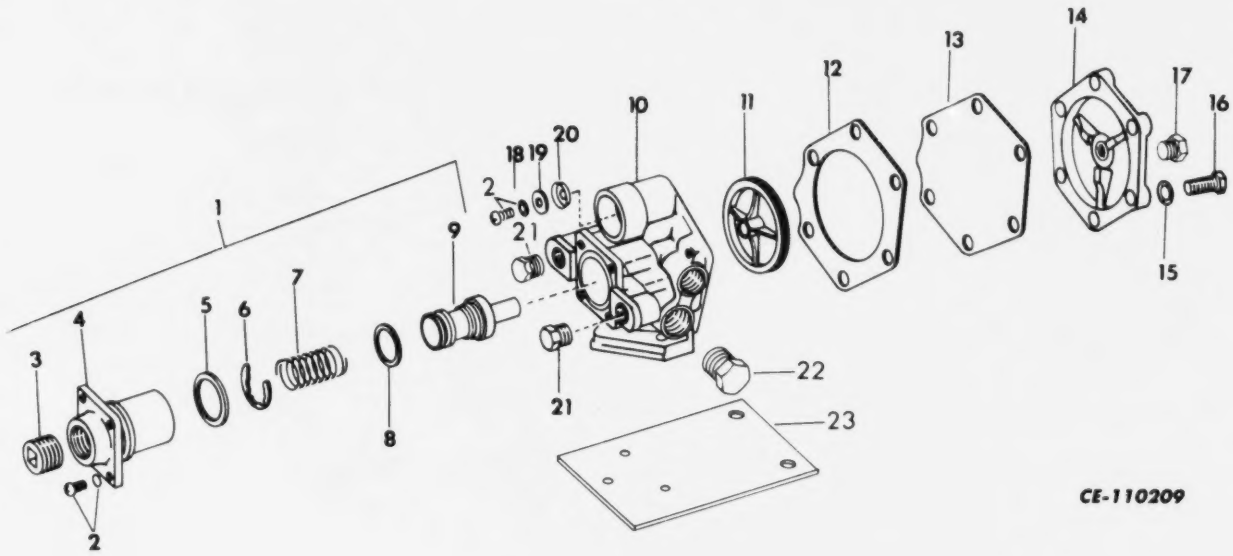
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| POWER CLUSTER - Continued | | |
| 1 | 106 823 C91 | KIT, maintenance cluster (Assembly C)<br>(Consists of -<br>1 BOOT 211 736 H1<br>1 CUP 165 716 H1<br>1 WIPER 165 718 H1 ) |
| | 704 702 C91 | KIT, power cluster repair (Assembly B)<br>(Consists of -<br>1 BOOT 211 736 H1<br>§ 1 CUP<br>1 CUP 165 716 H1<br>§ 1 PISTON ASSY<br>1 RING 169 040 H1<br>1 VALVE 165 732 H1<br>1 WIPER 165 718 H1 ) |
| | 704 680 C91 | KIT, master cylinder repair (Assembly B w/Master Cylinder, 338 428 R91)<br>(Consists of -<br>1 CUP 68 347 H<br>§ 1 CUP<br>§ 1 PISTON ASSY<br>1 RING, retaining 169 040 H1<br>1 VALVE 165 732 H1<br>§ 1 LOCKWIRE ) |

§ - Not furnished separately.

MEMORANDA

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

RELAY VALVE & MOUNTING
U001541 and up, and also 01535
and 01537 thru 01539
C0* and up




| | | |
|---|---|---|
| | 182 778 H1 | RELAY VALVE ASSEMBLY (Includes items 1 thru 22) |
| | 24 841 R1 | BOLT (3) |
| | 25 544 R1 | WASHER, flat (6) |
| | 9 413 979 | NUT (3) |
| 1 | 184 955 H1 | INLET VALVE AND GUIDE CAP |
| 2 | 186 025 H1 | SCREW, w/lockwasher (4) |
| 3 | 180 140 H1 | PLUG |
| 4 | 184 958 H1 | CAP, valve guide |
| 5 | 184 959 H1 | GROMMET |
| 6 | 184 961 H1 | RING, retaining |
| 7 | 184 960 H1 | SPRING |
| 8 | 184 957 H1 | GROMMET |
| 9 | 184 956 H1 | VALVE, inlet |
| 10 | 184 954 H1 | BODY |
| 11 | 184 962 H1 | GUIDE, diaphragm |
| 12 | 184 963 H1 | RING, diaphragm |
| 13 | 184 964 H1 | DIAPHRAGM |
| 14 | 184 965 H1 | COVER |
| 15 | 103 320 | WASHER, lock (6) |
| 16 | 173 403 H1 | BOLT (6) |
| 17 | 154 944 H1 | PLUG |
| 18 | 186 025 H1 | SCREW, w/lockwasher |
| 19 | 184 967 H1 | WASHER, diaphragm |
| 20 | 184 966 H1 | DIAPHRAGM, exhaust |
| 21 | 184 968 H1 | PLUG, (2) |
| 22 | 184 969 H1 | PLUG |
| 23 | 933 569 C1 | PLATE, relay valve mounting |
| | 24 841 R1 | BOLT (2) |
| | 25 544 R1 | WASHER, flat (4) |
| | 9 413 979 | NUT (2) |

* - Serial Number Not Available.



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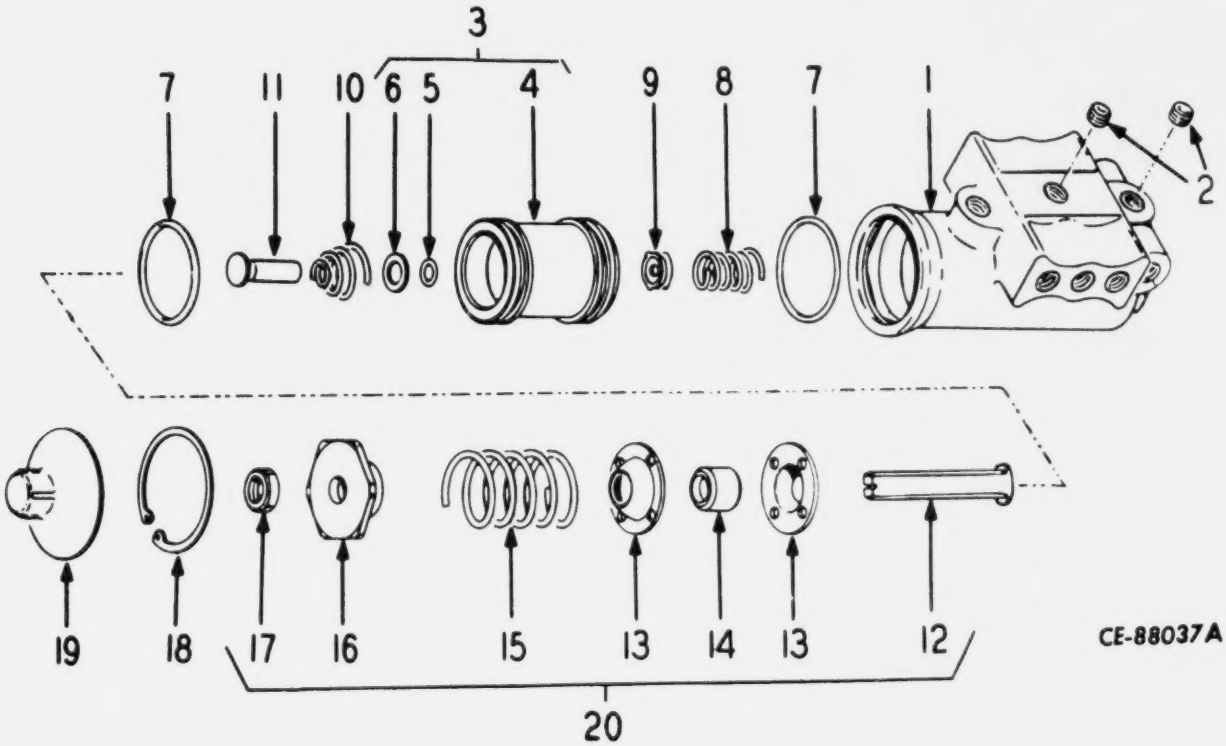
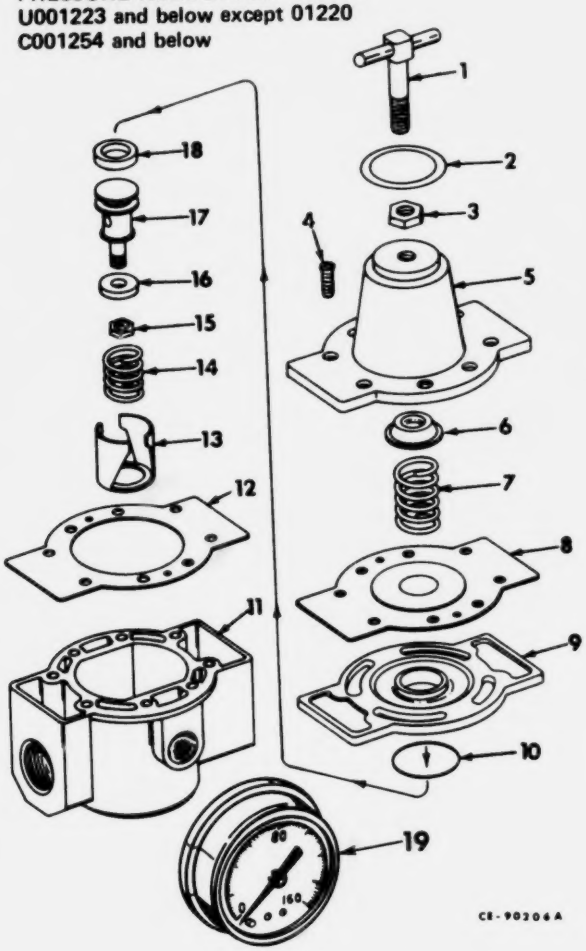
GOVERNOR




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 160 446 H2 | GOVERNOR ASSEMBLY (Consists of the following parts) |
| 1 | 177 618 H1 | BODY |
| 2 | 321 738 R1 | FILTER (2) |
| 3 | 177 620 H1 | PISTON ASSEMBLY |
| 4 | 177 621 H1 | PISTON |
| 5 | 361 883 R1 | "O" RING |
| 6 | 177 622 H1 | WASHER |
| 7 | 177 625 H1 | GROMMET, piston (2) |
| 8 | 321 745 R1 | SPRING, valve |
| 9 | 321 744 R1 | VALVE w/insert |
| 10 | 321 742 R1 | SPRING, exhaust stem |
| 11 | 177 627 H1 | STEM, exhaust |
| 12 | 321 746 R1 | SCREW, adjusting |
| 13 | 321 748 R1 | SEAT, spring (Lower) (2) |
| 14 | 321 749 R1 | GUIDE, spring |
| 15 | 321 747 R1 | SPRING |
| 16 | | SEAT, spring (upper) (Not furnished separately) |
| 17 | 139 879 H | NUT, special |
| 18 | 160 094 R1 | RING, retaining |
| 19 | 321 739 R1 | COVER |
| 20 | 321 740 R91 | ADJUSTING SCREW & SPRING ASSEMBLY |
| | 177 601 H1 | BODY, 177 618 H1 w/two FILTER, 321 738 R1 |
| | 151 425 H1 | PLUG, pipe (In body ports) (4) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**PRESSURE REGULATOR VALVE**
**U001223 and below except 01220**
**C001254 and below**




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 878 195 C91 | VALVE, Pressure Regulator (Consists of the following parts) |
| 1 | | SCREW, adjusting |
| 2 | | PLATE, name |
| 3 | | NUT, lock |
| 4 | | SCREW (8) |
| 5 | | BONNET |
| 6 | | SPRING, seat |
| 7 | | SPRING, control |
| 8 | | DIAPHRAGM * |
| 9 | | CARTRIDGE |
| 10 | | "O" RING * |
| 11 | | BODY, with 1/2 NPT ports |
| 12 | | GASKET * |
| 13 | | SHIELD, gauge port |
| 14 | | SPRING, compensation |
| 15 | | NUT, lock |
| 16 | | POPPET * |
| 17 | | PISTON |
| 18 | | SEAL, piston * |
| 19 | 879 784 C1 | GAUGE, pressure (125 PSI) |
| | | PLUG, gauge port (2) |
| | 879 785 C91 | KIT, service (Consists of - § 1 CARTRIDGE § 1 GASKET § 1 POPPET § 1 SEAL § 1 "O" RING ) |

(*) - Part of Service Kit 879 785 C91
(§) - Not furnished separately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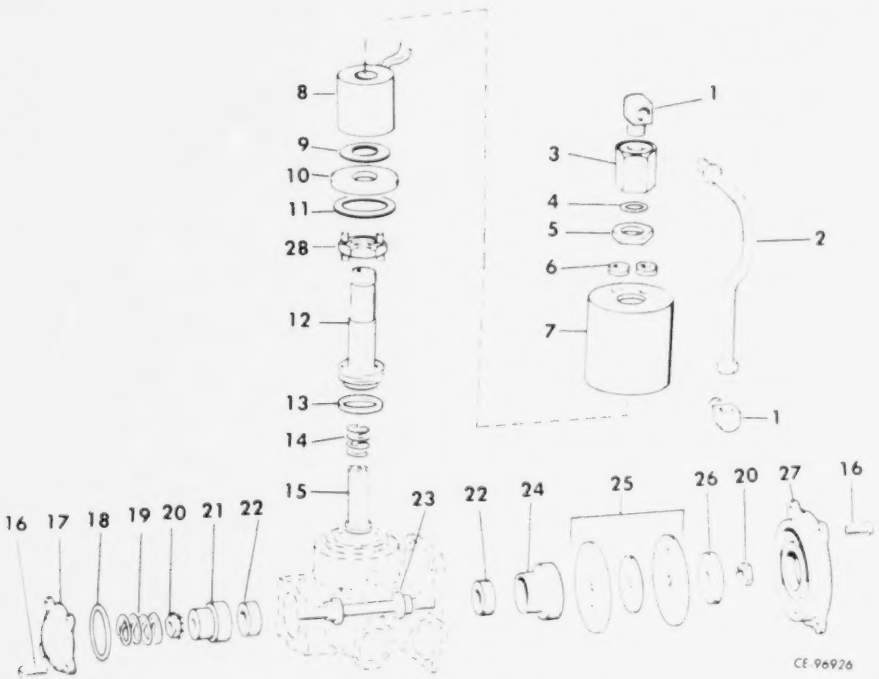
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**SOLENOID VALVE**
**U001223 and below except 01220**
**C001254 and below**




| | | |
|---|---|---|
| | 878 135 C91 | VALVE, Solenoid (Includes Items 1 thru 28) |
| 1 | | ELBOW (Not furnished separately) (2) |
| 2 | 879 148 C1 | TUBE & FITTING |
| 3 | | ADAPTER, Sleeve (Not furnished separately) |
| 4 | | SEAL, Adapter (Not furnished separately) (*) |
| 5 | | NUT, Housing (Not furnished separately) |
| 6 | | GROMMET (Not furnished separately) (2) |
| 7 | | HOUSING (Not furnished separately) |
| *8 | 926 968 C1 | COIL |
| 9 | | WASHER, Coil (Not furnished separately) |
| 10 | | PLATE, Flux (Not furnished separately) |
| 11 | | WASHER, Spring (Not furnished separately) |
| 12 | | SLEEVE (Not furnished separately) |
| 13 | | SEAL, Flange (Not furnished separately) (*) |
| 14 | | SPRING, Plunger (Not furnished separately) (*) |
| 15 | | PLUNGER (Not furnished separately) (*) |
| 16 | | SCREW & LOCKWASHER (Not furnished separately) (8) |
| 17 | | COVER (Not furnished separately) |
| 18 | | "O" RING (Not furnished separately) (#) |
| 19 | | SPRING, Spindle (Not furnished separately) (#) |
| 20 | | NUT & LOCKWASHER (Not furnished separately) |

(#) - Part of Repair Kit, 927 460 C91
(*) - Part of Repair Kit, 927 461 C91

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|
| **SOLENOID VALVE - Continued** | | | | | |
| **U001223 and below except 01220** | | | | | |
| **C001254 and below** | | | | | |
| 21 | | RETAINER, Seal (Not furnished separately) | | | |
| 22 | | SEAL, Orifice (Not furnished separately) (#) (2) | | | |
| 23 | | SPINDLE (Not furnished separately) | | | |
| 24 | | RETAINER, Seal (Not furnished separately) | | | |
| 25 | | DIAPHRAGM (Not furnished separately) | | | |
| 26 | | RETAINER, Diaphragm (Not furnished separately) | | | |
| 27 | | COVER, Diaphragm (Not furnished separately) | | | |
| 28 | | NUT, Wrench (Not furnished separately) (*) | | | |
| | 133 832 H1 | TERMINAL (Not part of Valve Assembly Must be Ordered Separately (2) | | | |
| | 927 460 C91 | KIT, repair (Includes items 18, 19, and 22) | | | |
| | 927 461 C91 | KIT, repair (Includes items 4, 13, 14 15 and 28 | | | |

(#) - Part of Repair Kit, 927 460 C91
(*) - Part of Repair Kit, 927 461 C91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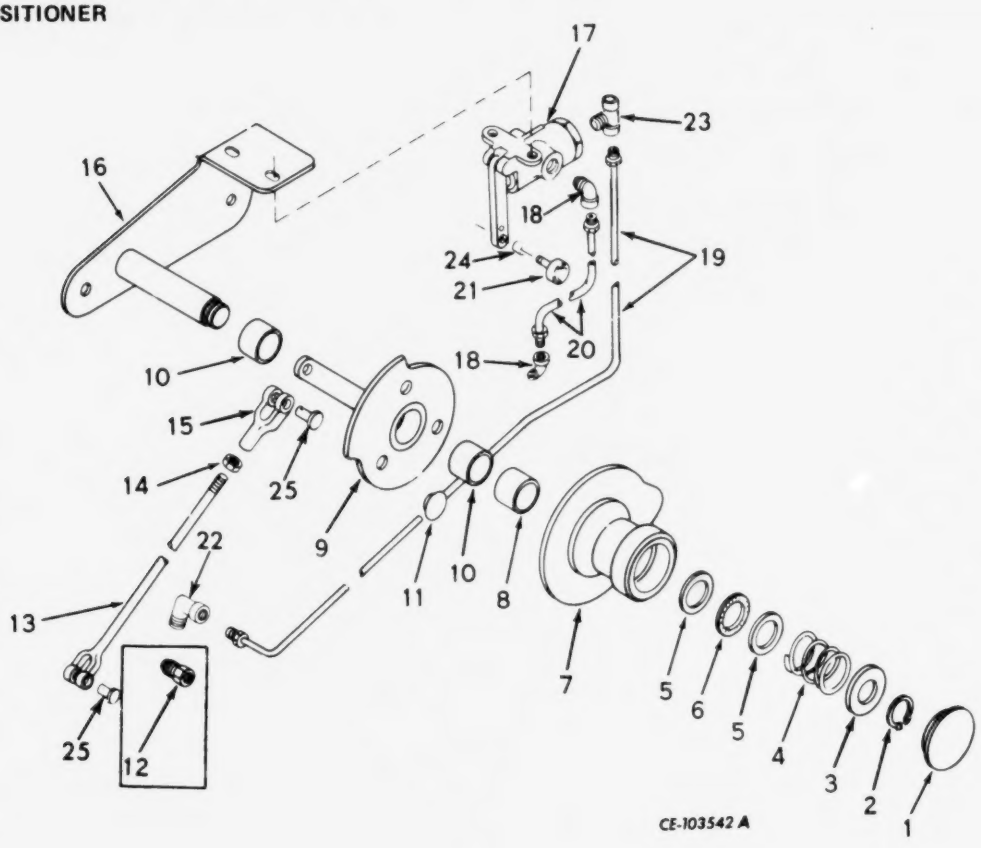
BOOM POSITIONER




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 127 741 | PLUG, button |
| 2 | 454 331 R1 | RING, retaining |
| 3 | 202 599 H1 | RETAINER |
| 4 | 210 843 H1 | SPRING |
| 5 | 306 970 R1 | WASHER, thrust (2) |
| 6 | 368 372 R91 | BEARING, thrust |
| 7 | 202 595 H1 | KNOB w/Bushing 144 244 H1 |
| 8 | 144 244 H1 | BUSHING |
| 9 | 202 590 H1 | INDICATOR w/two Bushing 144 244 H1 |
| 10 | 144 244 H1 | BUSHING (2) |
| 11 | 202 602 H1 | GROMMET, bumper (3) |
| 12 | 59 730 | CONNECTOR w/o NUT |
| | 414 504 C1 | INSERT<br>01255 and below |
| 13 | 202 600 H1 | YOKE, end (Not used on units equipped with Roll-Over Protective Structure) |
| 13 | 929 226 C1 | YOKE, end (Used only on units equipped with Roll-Over Protective Structure) |
| 14 | 114 493 | NUT, 5/16" - 24 jam |
| 15 | 104 037 | YOKE, adjustable - 5/16" |
| 16 | 202 587 H1 | BRACKET |
| | 181 361 | 3/8NF x 7/8" BOLT (2) |
| | 103 026 | 3/8 - 24 hex NUT (2) |
| | 103 321 | 3/8" lock WASHER (2) |
| 17 | | VALVE, control (See Control Valve in this Section) |
| | 181 314 | 1/4NF x 7/8" BOLT (2) |
| | 103 024 | 1/4"NF hex NUT (2) |
| | 120 380 | 1/4" lock WASHER (2) |
| | 106 261 | 1/4" flat WASHER (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

BOOM POSITIONER - Continued.

| | | |
|---|---|---|
| 18 | 252 374 R1 | ELBOW, w/o NUT (2) |
| | 414 504 C1 | INSERT (2) |
| 19 | | TUBE, w/o NUT, cut length 1/4" OD x 80" cut from bulk tube 417 196 C1 |
| | 29 898 D | 1/4" tube NUT (2) |
| 20 | | TUBE w/o NUT, cut length 1/4" OD x 55" cut from bulk tube 417 196 C1 |
| | 29 898 D | 1/4" tube NUT (2) |
| 21 | 210 917 H1 | FOLLOWER, cam w/Bushing 210 918 H1 |
| | 103 024 | 1/4 - 28 hex NUT |
| | 120 380 | 1/4" lock WASHER |
| 22 | 941 041 C1 | ELBOW w/o NUT |
| | 414 504 C1 | INSERT 01256 and up |
| 23 | 444 256 | TEE |
| 24 | 210 918 H1 | BUSHING |
| 25 | 114 784 | PIN, yoke (2) |
| | 103 374 | PIN, cotter (2) |
| | 417 196 C1 | TUBE, 1/4" x 50 feet (x) |

(x) - As required.



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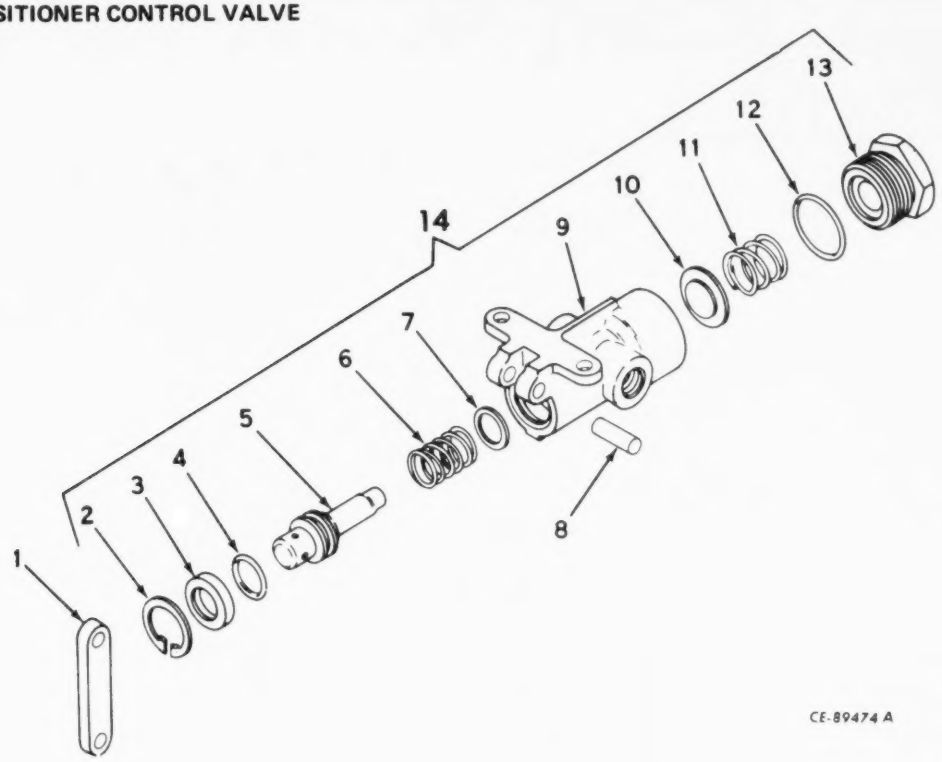
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## BOOM POSITIONER CONTROL VALVE

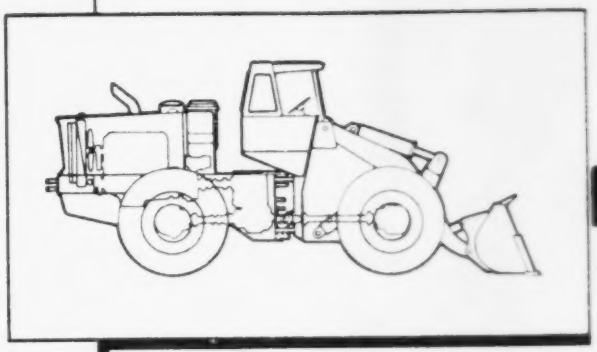



Parts without letters after the description indicate the part is used for all Boom Positioner Control Valves listed below: Letters "A" and "B" are used to identify separate Boom Positioner Control Valve.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 186 634 H1 | VALVE, control (Order Control Valve, 922 845 C91) |
| B | 922 845 C91 | VALVE, control |
| 1 | 188 577 H1 | LEVER |
| 2 | 373 173 R1 | RING, retaining |
| 3 | 188 572 H1 | SEAL, plunger |
| 4 | 878 206 C1 | GROMMET, plunger |
| 5 | 188 571 H1 | PLUNGER |
| 6 | 188 570 H1 | SPRING |
| 7 | | WASHER (Not furnished separately) |
| 8 | 188 576 H1 | PIN |
| 9 | 188 563 H1 | BODY (Control Valve A) |
| 9 | 878 921 C1 | BODY (Control Valve B) |
| 10 | 188 564 H1 | VALVE |
| 11 | 188 565 H1 | SPRING |
| 12 | 188 567 H1 | RING, sealing (Control Valve A) |
| 12 | 924 383 C1 | "O" RING |
| 13 | 188 568 H1 | CAP |
| 14 | 188 562 H1 | VALVE, emergency control (Control Valve A) |
| 14 | 923 051 C91 | VALVE, emergency control (Control Valve B) |

SECTION 4

# BRAKES & CONTROLS



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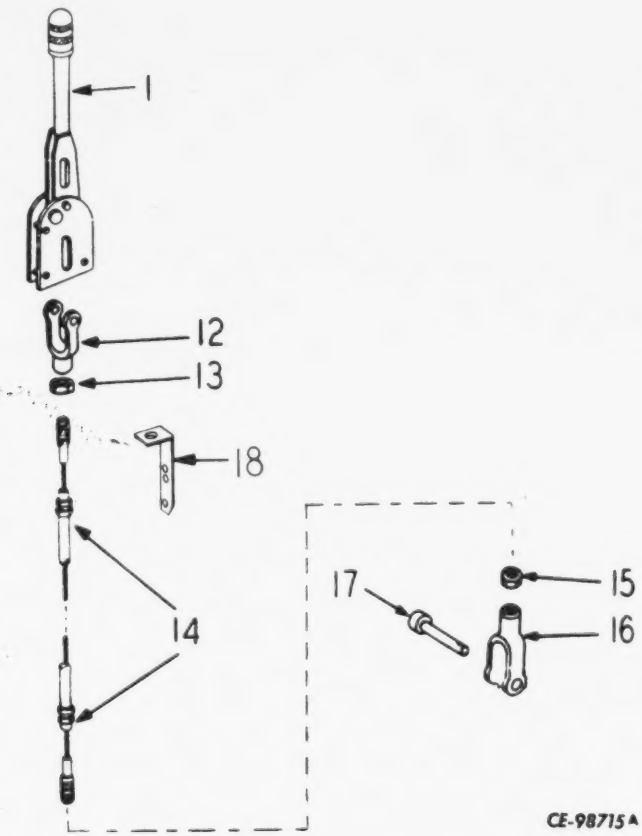
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## PARKING BRAKE LINKAGE




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | PARKING BRAKE LEVER ASSEMBLY (For components see Parking Brake Lever in this Section) |
| | 24 842 R1 | SCREW, cap (2) |
| | 25 534 R1 | WASHER, lock (2) |
| 12 | 104 037 | CLEVIS, 5/16" |
| 13 | 114 493 | NUT, 5/16"NF jam |
| 14 | 202 556 H1 | CABLE |
| 15 | 114 494 | NUT, 3/8"NF jam |
| 16 | 104 038 | YOKE |
| 17 | 114 785 | CLEVIS |
| | 103 374 | PIN, cotter |
| 18 | | NOT USED |
| | 166 801 H1 | CLAMP, cable to manifold |



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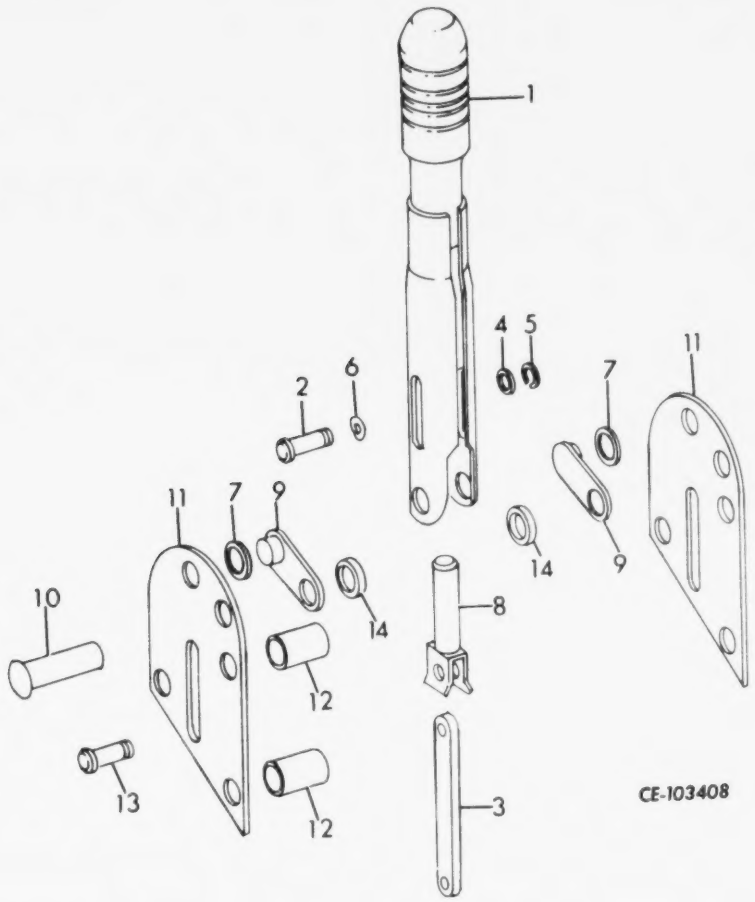
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

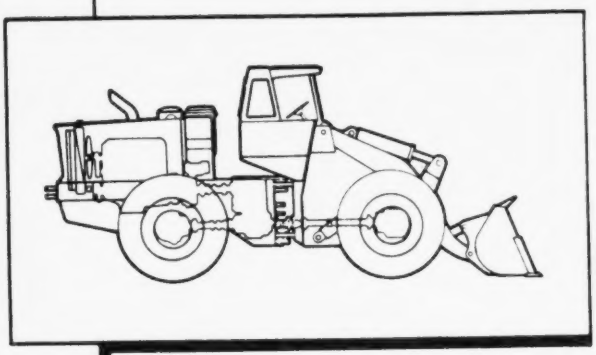
## PARKING BRAKE LEVER




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 115 086 H1 | PARKING BRAKE LEVER ASSY (Consists of the following parts - |
| 1 | | HANDLE LEVER (Not furnished separately) |
| 2 | 150 742 H1 | PIN |
| 3 | | LINK (Not furnished separately) |
| 4 | 103 340 | WASHER, 5/16" flat |
| 5 | 392 320 R1 | RING, retaining |
| 6 | 158 404 H1 | WASHER |
| 7 | | WASHER, 3/8" flat (Not furnished separately) (2) |
| 8 | | TUBE, adjusting (Not furnished separately) |
| 9 | | BRACKET, pivot (Not furnished separately) |
| 10 | | RIVET (Not furnished separately) |
| 11 | | BRACKET, mounting (Not furnished separately) |
| 12 | 134 704 H1 | SPACER (2) |
| 13 | 104 497 R2<br>103 373 | PIN<br>PIN, cotter |
| 14 | 104 936 R1 | SPACER (2) |

SECTION 5

# STEERING



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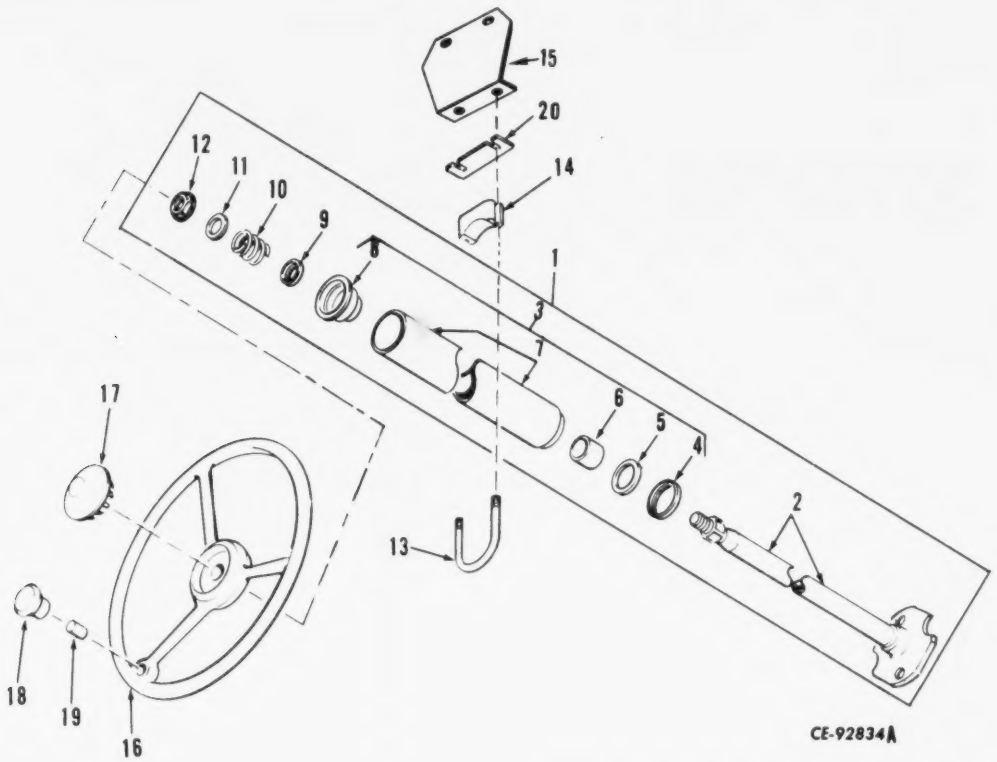
|---|---|---|---|---|---|

STEERING WHEEL AND POST




| | | | | | |
|---|---|---|---|---|---|
| 1 | 881 545 C91 | STEERING SHAFT COLUMN ASSEMBLY | 13 | 218 420 H1 | U-BOLT |
| | 27 036 R1 | NUT, 5/16" lock | | 25 534 R1 | WASHER, flat (2) |
| | 9 413 980 | NUT, 3/8" lock | | 9 413 979 | NUT, lock (2) |
| 2 | 884 876 C1 | SHAFT, flange and steering | 14 | 144 068 H1 | BLOCK, saddle |
| 3 | 884 877 C91 | JACKET ASSEMBLY | 15 | 153 492 H1 | BRACKET |
| | | | | 181 370 | 3/8NF x 1-1/4" BOLT (2) |
| 4 | 160 299 H1 | RETAINER, lower bearing seal | | 106 263 | 3/8" flat WASHER (4) |
| | | | | 103 321 | 3/8" lock WASHER (2) |
| 5 | 884 873 C1 | SEAL, steering shaft lower bearing | | 103 026 | 3/8NF NUT (2) |
| 6 | 884 875 C1 | BUSHING, steering shaft | 16 | 878 834 C1 | WHEEL, steering |
| 7 | 884 874 C1 | JACKET | 17 | 127 741 | CAP, plug button |
| 8 | 164 607 H1 | BEARING | 18 | 198 110 H1 | KNOB, spinner |
| | | | | 181 381 | BOLT |
| 9 | HA-1234 | SEAT, steering shaft bearing spring | | 103 341 | WASHER, flat |
| | | | | 120 382 | WASHER, lock |
| 10 | HA-1233 | SPRING, steering shaft bearing | | 114 494 | NUT, jam |
| 11 | HA-1492 | WASHER, steering wheel | 19 | 198 111 H1 | BUSHING, knob |
| 12 | 114 496 | NUT, 1/2" - 20NF jam | 20 | 218 408 H1 | SPACER (3) |



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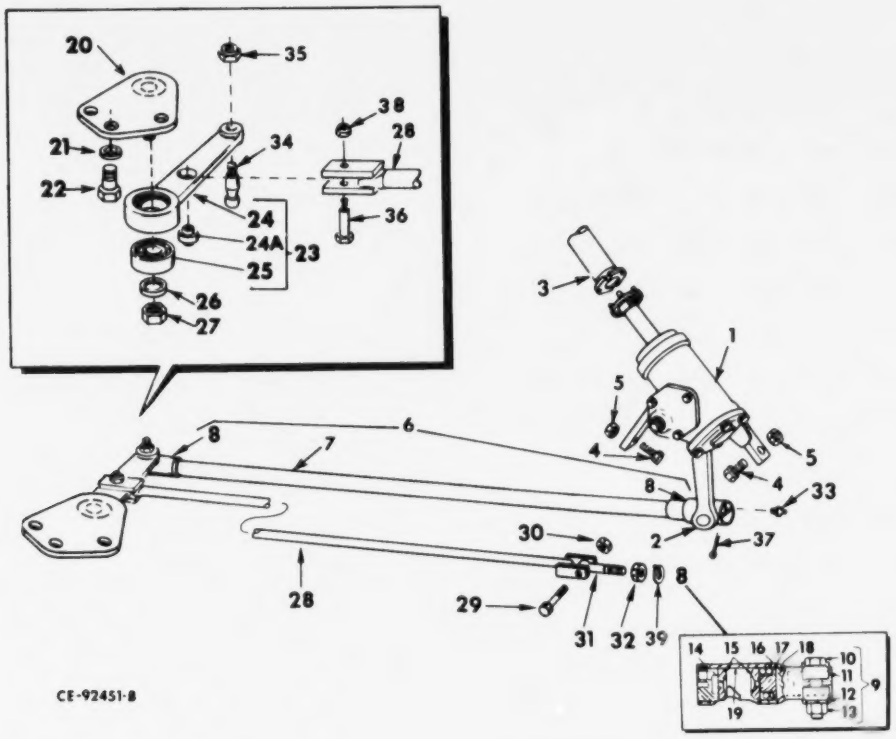
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## STEERING LINKAGE




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | GEAR, steering (See Steering Gear in this Section) |
| | 203 762 R1 | BOLT (3) |
| | 25 535 R1 | WASHER (3) |
| 2 | 884 051 C1 | ARM, Pitman |
| 3 | | COLUMN (See Steering Wheel and Post in this Section) |
| 4 | 271 583 | BOLT, 5/8NF x 1-1/2" (2) |
| 5 | 114 498 | NUT, 5/8"NF (2) |
| 6 | 885 917 C91 | LINK w/ROD 885 918 C1, two SOCKET 144 275 H2, Drag |
| 7 | 885 918 C1 | ROD, drag link |
| 8 | 144 275 H2 | SOCKET w/CLAMP 145 883 H1 (2) |
| 9 | 145 883 H1 | CLAMP ASSEMBLY (2) |
| 10 | 181 406 | BOLT, 7/16NF x 2" (2) |
| 11 | | CLAMP (Not furnished separately)(2) |
| 12 | 103 322 | WASHER, 7/16" lock (2) |
| 13 | 271 505 | NUT, 7/16"NF hex (2) |
| 14 | 145 862 H1 | PLUG (2) |
| 15 | 26 935 H | SEAT (4) |
| 16 | 120 654 H1 | SPRING (2) |
| 17 | 120 655 H1 | PLUG, safety (2) |
| 18 | 145 863 H1 | SEAT (2) |
| 19 | | BODY (Not furnished separately) |
| 20 | 883 453 C2 | PIVOT, plate |
| 21 | 120 382 | WASHER, lock (3) |
| 22 | 181 370 | BOLT, 3/8NF x 1-1/4" (3) |
| 23 | 884 169 C91 | LEVER ASSEMBLY |
| 24 | 884 168 C1 | LEVER |
| 24A | 221 440 H1 | BUSHING |
| 25 | 221 438 H1 | BEARING |
| 26 | 103 348 | WASHER, 1" flat |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **STEERING LINKAGE - Continued** | | |
| 27 | 19 256 R1 | NUT, 1"NF - 14 |
| 28 | 884 050 C2 | ROD, steering |
| 29 | 882 427 C1 | SCREW, special |
| 30 | 19 263 R1 | NUT, 5/8"NF - Esna |
| 31 | 923 564 C91 | ROD w/FITTING, 145 597, end |
| 32 | 219 753 | NUT, 3/4" - 16NF jam |
| 33 | 109 462 | FITTING, grease (2) |
| 34 | 157 085 H1 | STUD, ball |
| 35 | 19 263 R1 | NUT, 5/8 - 18NF Esna |
| 36 | 879 941 C1 | BOLT |
| 37 | 103 391 | PIN, cotter (2) |
| 38 | 17 234 R1 | NUT, 3/8NF Esna |
| 39 | 923 565 C1 | WASHER, lock (Not used on Units with Steering Gear 881 548 C91 |
| | 145 597 | FITTING, grease (Part of ROD, 923 564 C91) |



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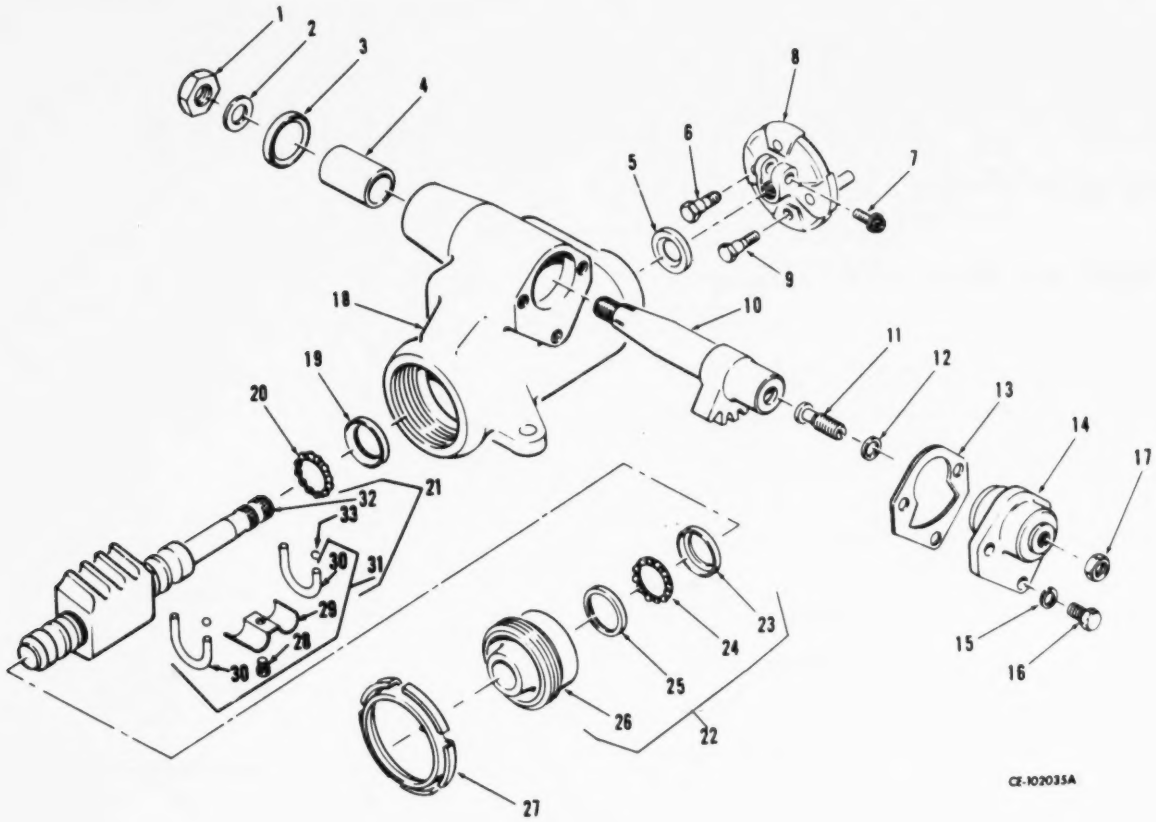
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## STEERING GEAR




Parts without Letters after the description indicates the part is used for all Steering Gears. Letters A and B are used to identify individual Steering Gears.

| | | |
|---|---|---|
| A | 881 548 C91 | STEERING CHUCK GEAR ASSEMBLY (Order Steering Chuck Gear, 881 548 C92)<br>U001239 and below<br>C001002 and up |
| B | 881 548 C92 | STEERING CHUCK GEAR ASSEMBLY (Consists of the following parts -<br>U001240 and up |
| 1 | 219 759 | NUT, pitman arm |
| 2 | 103 336 | WASHER, 7/8" lock |
| 3 | 390 663 C91 | SEAL, pitman shaft grease |
| 4 | 654 400 R1 | BUSHING, pitman shaft |
| 5 | 390 664 C91 | SEAL, steering shaft dust |
| 6 | 884 705 C1 | BOLT, steering shaft coupling |
| 7 | 426 528 C1 | BOLT, pinch |
| 8 | 884 704 C91 | FLANGE ASSEMBLY (Includes Items 6 & 9) |
| 9 | 160 306 H1 | BOLT, steering shaft coupling |
| 10 | 923 573 C1 | GEAR, pitman shaft |
| 11 | 390 616 C1 | ADJUSTER, steering gear lash |
| 12 | HA-1440 | SHIM (.063) |
| 12 | HA-1441 | SHIM (.065) |
| 12 | HA-1445 | SHIM (.067) |
| 12 | HA-1446 | SHIM (.069) |
| 13 | 654 405 R1 | GASKET, housing side cover |
| 14 | 390 655 C91 | COVER, housing side |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **STEERING GEAR - Continued** | | |
| 15 | 103 321 | WASHER, 3/8" lock (3) |
| 16 | 390 662 C1 | BOLT |
| 17 | 272 121 | NUT, 7/16"NF jam hex |
| 18 | 884 706 C91 | HOUSING, CUP & BUSHING ASSEMBLY (Includes items 4 & 19) |
| 19 | 654 396 R1 | CUP, worm thrust bearing |
| 20 | 654 395 R91 | BEARING, worm thrust |
| 21 | 884 707 C91 | WORM, assembly (Steering Gear A) |
| 21 | 923 572 C91 | WORM, assembly (Steering Gear B) |
| 22 | 654 394 R91 | WORM BEARING ADJUSTER ASSEMBLY |
| 23 | 654 397 R1 | RETAINER, lower bearing (Steering Gear A) |
| 24 | 654 395 R91 | BEARING, worm thrust |
| 25 | 654 396 R1 | CUP, worm thrust bearing |
| 26 | | ADJUSTER, worm thrust bearing (Not furnished separately) |
| 27 | 374 328 C1 | NUT, adjuster lock (optional w/NUT 654 408 R1) |
| 27 | 654 408 R1 | NUT, adjuster lock (optional w/NUT 374 328 C1) |
| 28 | | BOLT & WASHER |
| 29 | | CLAMP, ball return guide |
| 30 | | GUIDE, ball return (4) |
| 31 | 884 710 C91 | KIT, guide service (Consists of - 1 BOLT & WASHER ASSEMBLY 1 CLAMP, ball return guide (L.H. lead) 4 GUIDE, ball return (L.H. lead) |
| 32 | | NUT, ball (Not furnished separately) |
| 33 | | BALL (Not furnished separately) (54) |
| | 122 511 H1 | KIT, steering gear lash adjuster (Consists of - 1 SHIM (.063) HA-1440 1 SHIM (.065) HA-1441 1 SHIM (.067) HA-1445 1 SHIM (.069) HA-1446) |



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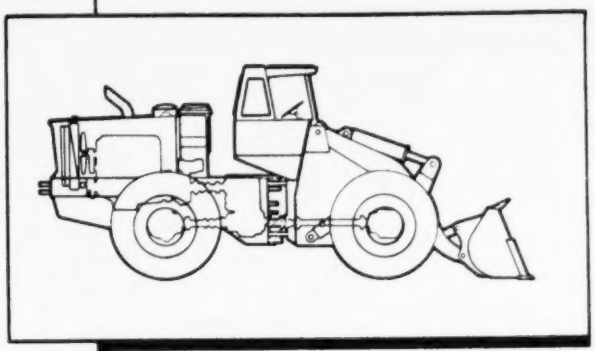
# SECTION 6

# COOLING



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| SAND GRID KIT | 6-2 |
| SAND GRID KIT | 6-4 |


NOTE: For details of water pump, engine oil cooler and other engine mounted cooling system components of the IH-DT-817B Engine, refer to Section 12.

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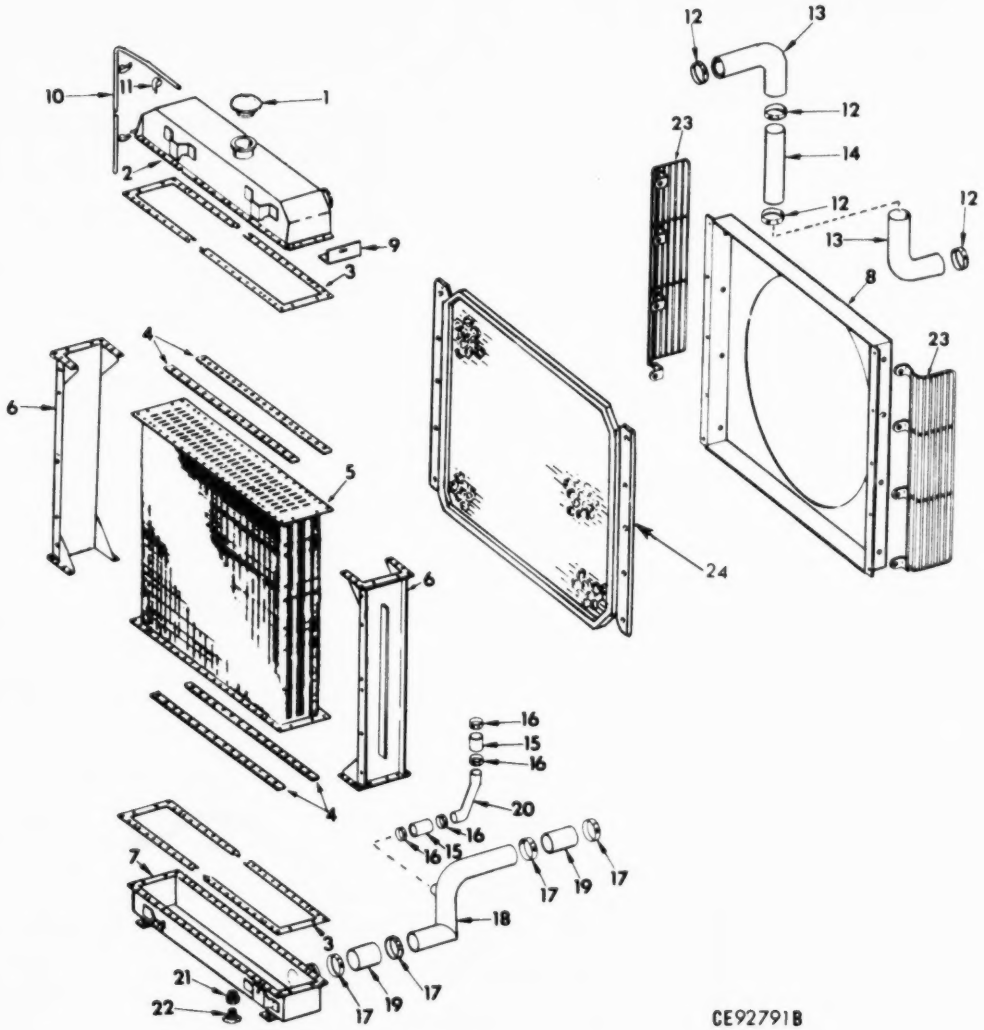
## RADIATOR AND PIPING
(I.H.)



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## RADIATOR AND PIPING - Continued (I.H.)

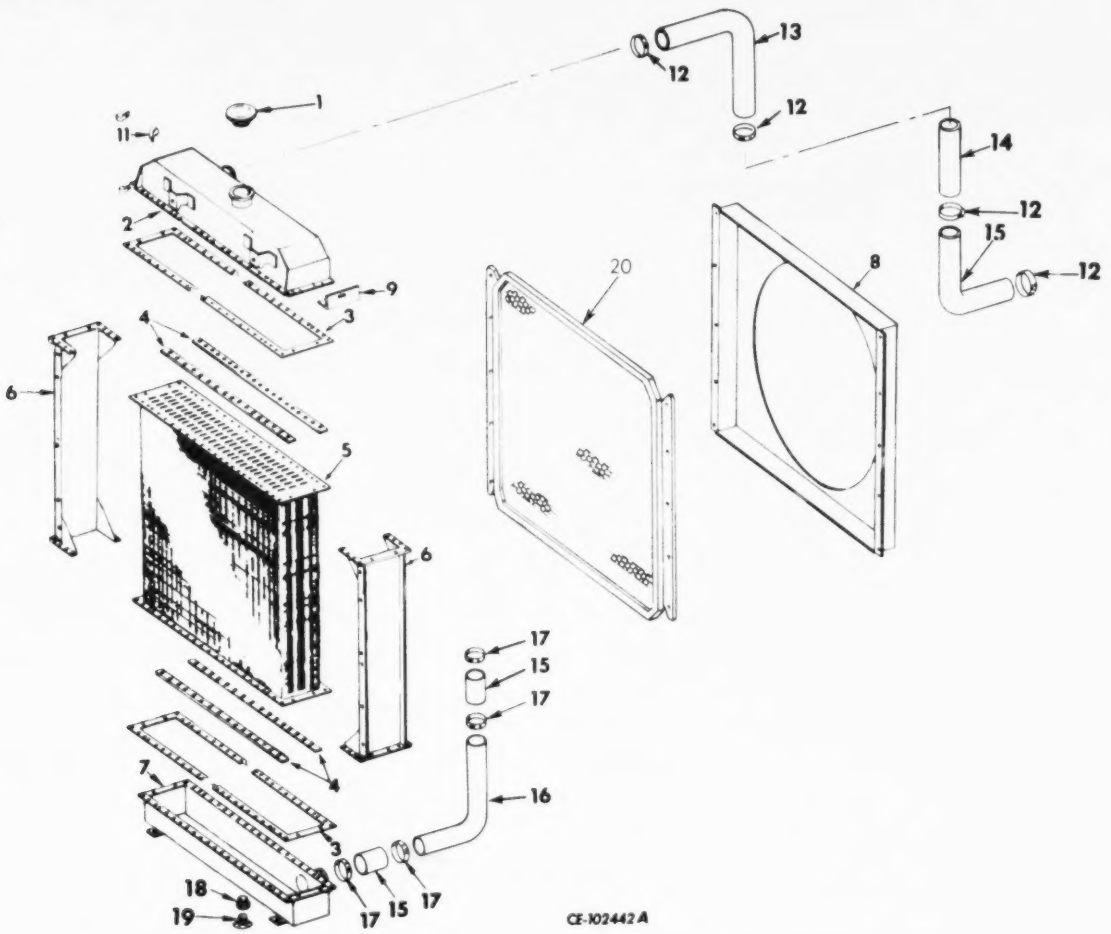
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 361 705 R91 | CAP, pressure |
| 2 | 884 171 C1 | TANK, top |
| | 179 818 | BOLT, 5/16NC x 1" (44) |
| | 103 320 | WASHER, 5/16" lock (44) |
| | 102 634 | NUT, 5/16 hex (44) |
| 3 | 876 827 C1 | GASKET (2) |
| 4 | 876 851 C1 | WASHER, core (4) |
| 5 | 884 175 C1 | CORE |
| 6 | 884 173 C1 | SIDE, left hand |
| 6 | 884 174 C1 | SIDE, right hand |
| | 179 791 | BOLT, 1/4NC x 1/2" (14) |
| | 103 319 | WASHER, 1/4" lock (14) |
| | 25 519 R1 | NUT, 1/4"NC hex (14) |
| 7 | 884 172 C1 | TANK, bottom (With Internal Oil Cooler) |
| | 103 320 | WASHER, 5/16" lock (46) |
| | 25 751 R1 | BOLT, 5/16NC x 1-1/4" (20) |
| | 179 818 | BOLT, 5/16NC x 1" (26) |
| | 102 634 | NUT, 5/16" hex (44) |
| 8 | 884 176 C3 | SHROUD |
| 9 | 876 829 C1 | CLIP, adjustable (2) |
| 10 | 884 177 C1 | TUBE, overflow |
| 11 | 884 178 C1 | CLIP, overflow (4) |
| 12 | 182 491 H1 | CLAMP, hose (4) |
| 13 | 188 013 H1 | HOSE (2) |
| 14 | 885 322 C1 | TUBE |
| 15 | | HOSE (cut length 2-1/4" I.D. x 4" long) (Cut from bulk HOSE, 407 010 R1) (2) |
| 16 | 153 678 H1 | CLAMP, hose (4) |
| 17 | 156 385 H1 | CLAMP, hose (4) |
| 18 | 198 831 H1 | TUBE, engine to radiator |
| 19 | | HOSE (cut length 3-1/2 I.D. x 4" long) (Cut from bulk HOSE, 407 406 R1) (2) |
| 20 | 187 998 H1 | TUBE, radiator by-pass |
| 21 | 144 049 | ADAPTER, pipe reducer |
| 22 | 153 490 H1 | DRAIN, cock |
| 23 | 930 220 C1 | GUARD, fan (2) |
| | 572 254 | NUT (8) |
| | 24 839 R1 | SCREW, 3/4" hex-hd cap (8) |
| | 24 875 R1 | BOLT, 5/8NF x 2" (4) ) Radia- |
| | 18 453 R1 | NUT, 5/8NF x 18 (4) ) tor |
| | 25 547 R1 | WASHER, 5/8" (8) ) Mount- ing |
| | 25 533 R1 | WASHER, 5/16 flat (6) |
| 24 | 938 569 C1 | GRID, sand (Part of Sand Grid Kit) |
| | 407 010 R1 | HOSE, bulk 2-1/4" I.D. x 3 ft. (#) (x) |
| | 407 406 R1 | HOSE, bulk 3-1/2" I.D. x 3 ft. (#) (x) |
| | 930 229 C91 | KIT, fan guard (See Note 1) (Consists of - 8 BOLT 179 834; 2 GUARD 930 220 C1; 8 NUT 572 254 R1; 8 WASHER 103 321; 1 INSTALLATION FGH-13986) |
| | 938 582 C91 | KIT, sand grid (Consists of - 1 GRID 938 569 C1; 1 DRAWING FGH-14898) |

Note 1 - Order on "Machine Order" form.

(#) - Part number and price covers one foot of bulk item.

(x) - As required.

RADIATOR AND PIPING (Cummins)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 361 705 R91 | CAP, 7# pressure |
| 2 | 927 884 C1 | TANK, top |
| | 113 865 | BOLT, 5/16 x 1-1/4" Rd. Hd. Mach. (26) |
| | 113 863 | BOLT, 5/16 x 1" Rd. Hd. Mach. (14) |
| | 103 320 | WASHER, 5/16" lock (40) |
| | 102 634 | NUT, 5/16" hex (34) |
| 3 | 924 864 C1 | GASKET, header (2) |
| 4 | 924 863 C1 | BAR, header (4) |
| 5 | 927 881 C1 | CORE |
| 6 | 927 883 C1 | SIDE (2) |
| | 113 955 | SCREW, 1/4" x 1/2" R. Hd. Mach. (10) |
| | 103 319 | WASHER, 1/4" lock (10) |
| 7 | 927 885 C1 | TANK, bottom |
| | 113 863 | BOLT, 5/16 x 1" Rd. Hd. Mach. (46) |
| | 103 320 | WASHER, 5/16" lock (46) |
| | 102 634 | NUT, 5/16" hex (46) |
| 8 | 927 882 C1 | SHROUD |
| 9 | 924 861 C1 | CLIP (2) |
| | 113 865 | SCREW, 5/16" x 1-1/4" Rd. Hd. Mach. (6) |
| | 103 320 | WASHER, 5/16" lock (6) |
| | 106 261 | WASHER, 5/16" flat (6) |
| 11 | 927 886 C1 | CLIP, overflow (3) |
| 12 | 153 678 H1 | CLAMP (8) |

(x) - As Required.

(*) - Part number and price covers one foot of bulk item.



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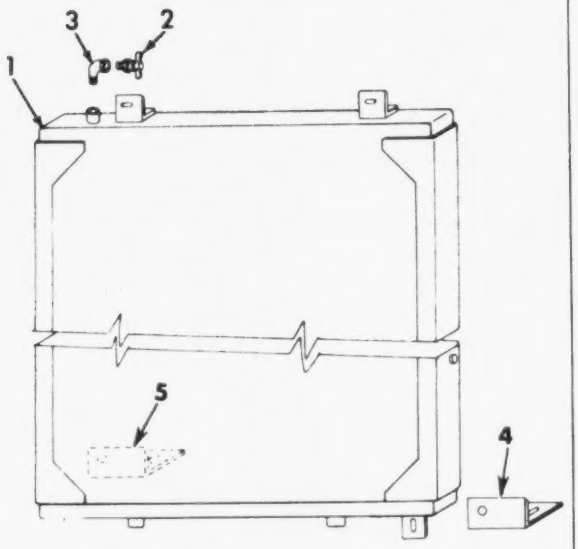
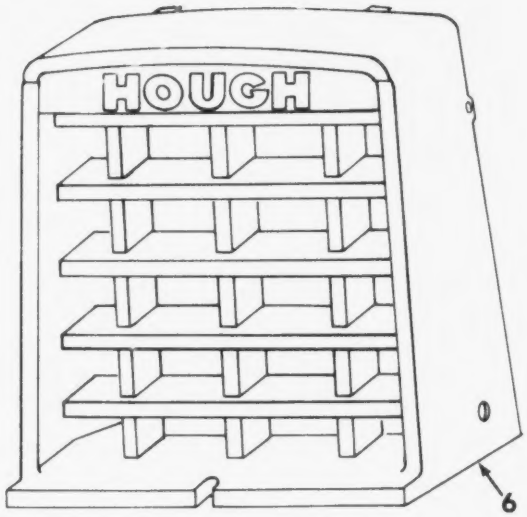
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **RADIATOR AND PIPING (Cummins) - Continued** |
| 13 | 203 604 H1 | HOSE |
| 14 | 194 543 H1 | TUBE |
| 15 | 882 730 C1 | HOSE |
| 16 | | HOSE, (cut length 2-1/4" I.D. x 4" long) (Cut from bulk HOSE, 407 010 R1) (2) |
| 17 | 198 832 H1 | TUBE |
| 18 | 144 049 | ADAPTER |
| 19 | 153 490 H1 | COCK, drain |
| 20 | 938 569 C1 | GRID, sand (Part of Sand Grid Kit) |
| | 271 583 | BOLT, 5/8NF x 1-1/2" (2) ) |
| | 271 587 | BOLT, 5/8NF x 2" (2) ) Radiator |
| | 18 453 R1 | NUT, 5/8NF Esna (4) ) Mounting |
| | 106 267 | WASHER, 5/8" flat (4) ) |
| | 407 010 R1 | HOSE, bulk 2-1/4" I.D. x 3 ft. (#) (x) |
| | 938 582 C91 | KIT, sand grid (Consists of 1 GRID 938 569 C1, 1 DRAWING FGH-14898) |

(#) - Part number and price covers one foot of bulk item.

(x) - As Required.

RADIATOR GRILLE AND CONVERTER OIL COOLER




CE-92774

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 884 035 C1 | COOLER, oil |
| | 25 522 R1 | NUT (4) |
| | 140 483 H | SCREW, hex-hd cap (4) |
| | 25 544 R1 | WASHER, flat (8) |
| 2 | 103 647 | PETCOCK |
| 3 | 105 423 | ELBOW, street |
| 4 | 875 769 C1 | ANGLE, R.H. |
| 5 | 875 768 C1 | ANGLE, L.H. |
| 6 | 148 177 H2 | GRILLE |
| | 24 895 R1 | BOLT, 4-1/2" long (2) |
| | 26 523 R1 | BOLT, 5-1/4" long |
| | 25 557 R1 | WASHER, 3/4" flat (2) |
| | 25 548 R1 | WASHER, 3/4" flat |
| 9 | 413 983 | NUT, lock (3) |



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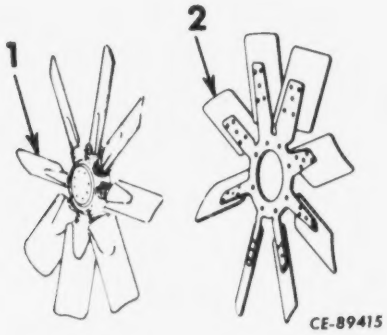
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

FAN



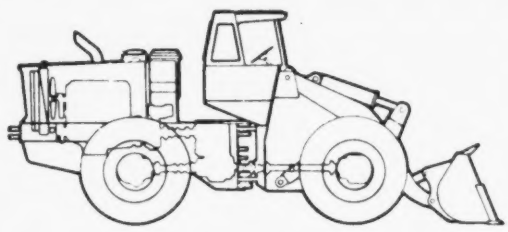

| | | |
|---|---|---|
| 1 | 889 180 C1 | FAN, reversible (I.H. Engine) |
| 1 | 221 146 H1 | FAN, reversible (Cummins Engine) |
| 2 | 890 640 C92 | FAN, blower (I.H. Engine) |
| 9 | 413 979 | NUT (8) |
| | 24 842 R1 | SCREW, hex-hd cap (8) |
| | 25 544 R1 | WASHER (16) |
| 2 | 199 873 H1 | FAN, blower (Cummins Engine) |

KIT, reversible fan (I.H. Engine)
(Order the following parts -
1 FAN 889 180 C1
1 FRAME
REWORK 889 183 C1 )

KIT, reversible fan (Cummins Engine)
(Order the following parts -
1 FAN 221 146 H1
1 FRAME
REWORK 889 183 C1 )

# SECTION 7

# DRIVE TRAIN



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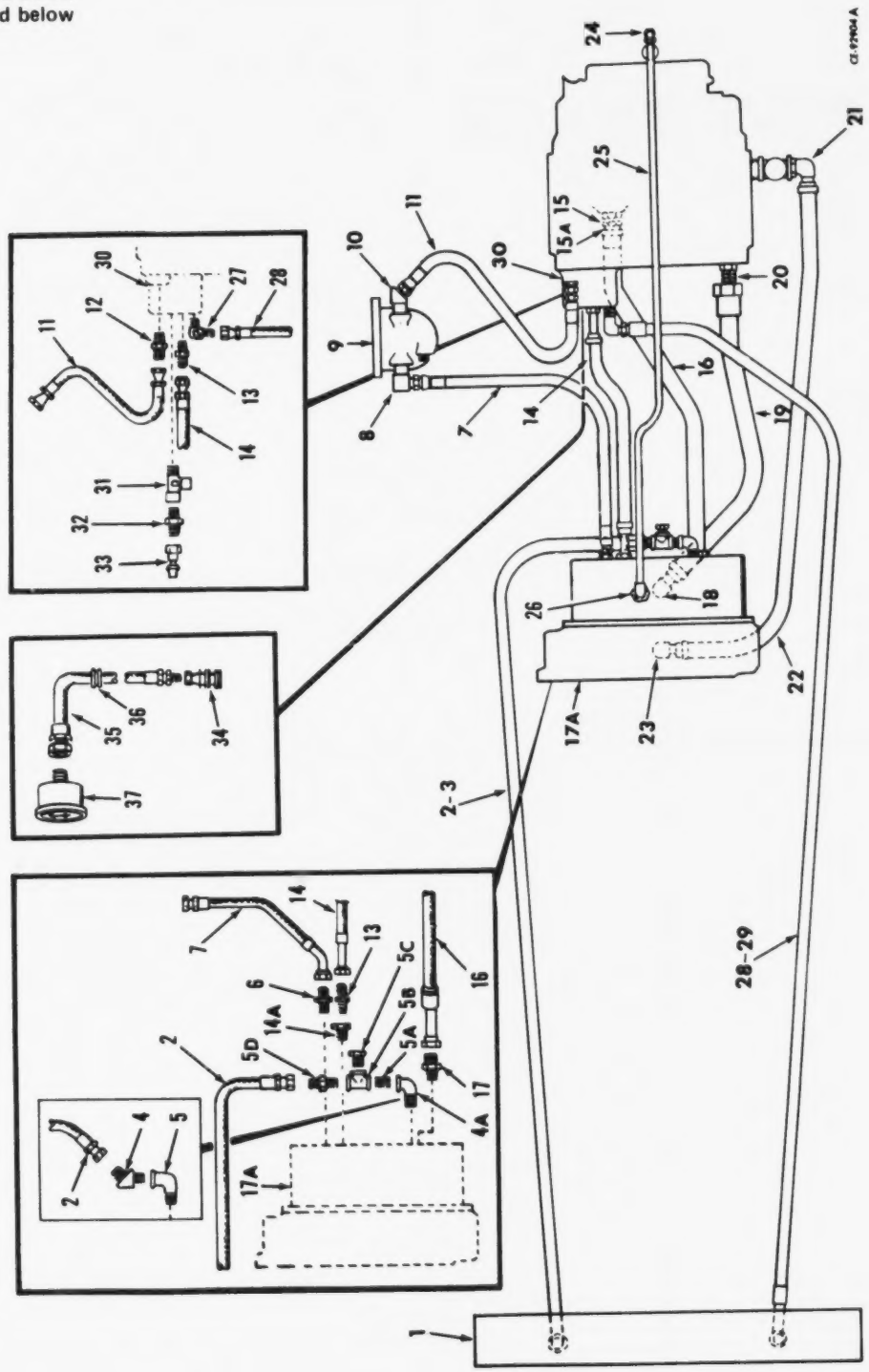
TRANSMISSION AND TORQUE CONVERTER LINES
U001175 and below
C001195 and below



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TRANSMISSION AND TORQUE CONVERTER LINES U001175 and below C001195 and below - Continued** |
| | | **LINE - CONVERTER TO COOLER** |
| 1 | | COOLER, oil (See Oil Cooler in Section 6) |
| 2 | 884 070 C1 | HOSE |
| 3 | 142 846 H1 | CLAMP, hose to frame (2) |
| | 181 315 | 1/4NF x 1" BOLT (2) |
| | 106 261 | 1/4" flat WASHER (2) |
| | 103 319 | 1/4" lock WASHER (2) |
| | 103 024 | 1/4"NF hex NUT (2) |
| 4 | 884 136 C1 | TEE, special (used with Torque Converter 884 026 C92) |
| 4A | 892 495 C1 | ELBOW, 90° (used with Torque Converter 892 460 C91) |
| 5 | 108 687 | ELBOW, 90° (used with Torque Converter 884 026 C92) |
| 5A | 127 874 | NIPPLE (used with Torque Converter 892 460 C91) |
| 5B | 115 237 | TEE (used with Torque Converter 892 460 C91) |
| 5C | 21 113 R1 | BUSHING, reducer (used with Torque Converter 892 460 C91) |
| 5D | 9 402 713 | CONNECTOR (Used with Torque Converter 892 460 C91) |
| | | **LINE - COOLER TO TRANSMISSION** |
| 6 | 9 402 711 | CONNECTOR |
| 7 | 884 137 C1 | HOSE, converter to filter |
| 8 | 9 402 867 | ELBOW, 90° |
| 9 | | FILTER (See Converter Line Oil Filter in this Section) |
| | 181 340 | 5/16NF x 1-1/8" BOLT (4) |
| | 615 031 R1 | 5/16" flat WASHER (4) |
| | 103 320 | 5/16" lock WASHER (4) |
| | 103 025 | 5/16"NF hex NUT (4) |
| 10 | 9 402 828 | ELBOW, 45° |
| 11 | 134 151 H1 | HOSE, filter to valve |
| 12 | 876 167 C1 | CONNECTOR |
| | | **LINE - CONTROL VALVE TO CONVERTER** |
| 13 | 9 402 711 | CONNECTOR (2) |
| 14 | 884 135 C1 | HOSE |
| 14A | 21 114 R1 | BUSHING, reducer (used with Torque Converter 892 460 C91) |
| | | **SUCTION LINE - TRANSMISSION TO CONVERTER** |
| 15 | 9 410 207 | UNION |
| 15A | 296 247 R1 | "O" RING |
| 16 | 884 134 C1 | HOSE |
| 17 | 9 402 713 | CONNECTOR |
| 17A | | CONVERTER, torque (See Torque Converter in this Section) |
| | | **DRAIN LINE - CONVERTER TO TRANSMISSION** |
| 18 | 9 402 869 | ELBOW, 90° |
| 19 | 884 066 C1 | HOSE |
| 20 | 9 402 831 | ELBOW, 45° |
| | | **DRAIN LINE - FLYWHEEL HOUSING TO TRANSMISSION** |
| 21 | 9 402 870 | ELBOW, 90° |
| 22 | 884 067 C1 | HOSE |

Also listed and illustrated in Section 11.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

TRANSMISSION AND TORQUE CONVERTER LINES - Continued

DRAIN LINE - FLYWHEEL HOUSING TO TRANSMISSION – Continued

| | | |
|---|---|---|
| | 140 860 H1 | CLAMP |
| | 181 397 | 7/16NF x 1-1/4" BOLT |
| | 103 322 | 7/16" lock WASHER |
| | 271 505 | 7/16NF NUT |
| 23 | 891 593 C1 | ELBOW, 90° |

LINE - CONVERTER VENT

| | | |
|---|---|---|
| 24 | 42 411 D | ELBOW, w/o NUT |
| | 414 505 C1 | INSERT |
| 25 | | TUBE, nylon w/o NUT, cut length 3/8 O.D. x 72" long cut from BULK TUBE, 417 199 C2 |
| | 37 165 D | NUT, 3/8" tube (2) |
| 26 | 144 048 | BUSHING, reducer |

LINE - COOLER TO TRANSMISSION

| | | |
|---|---|---|
| 27 | 9 402 869 | ELBOW, 90° |
| 28 | 884 071 C1 | HOSE |
| 29 | 142 846 H1 | CLAMP (2) |
| | 181 315 | 1/4NF x 1" BOLT (2) |
| | 106 261 | 1/4" flat WASHER (2) |
| | 103 319 | 1/4" lock WASHER (2) |
| | 103 024 | 1/4"NF hex NUT (2) |

QUICK DISCONNECT

| | | |
|---|---|---|
| 30 | | VALVE, regulator (See Regulator Valve in this Section) |
| 31 | 113 169 H1 | TEE 01034 and up except 01065 |
| 32 | 22 308 R1 | NIPPLE 01034 and up except 01065 |
| 33 | 342 775 R91 | CAP, quick disconnect 01034 and up except 01065 |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

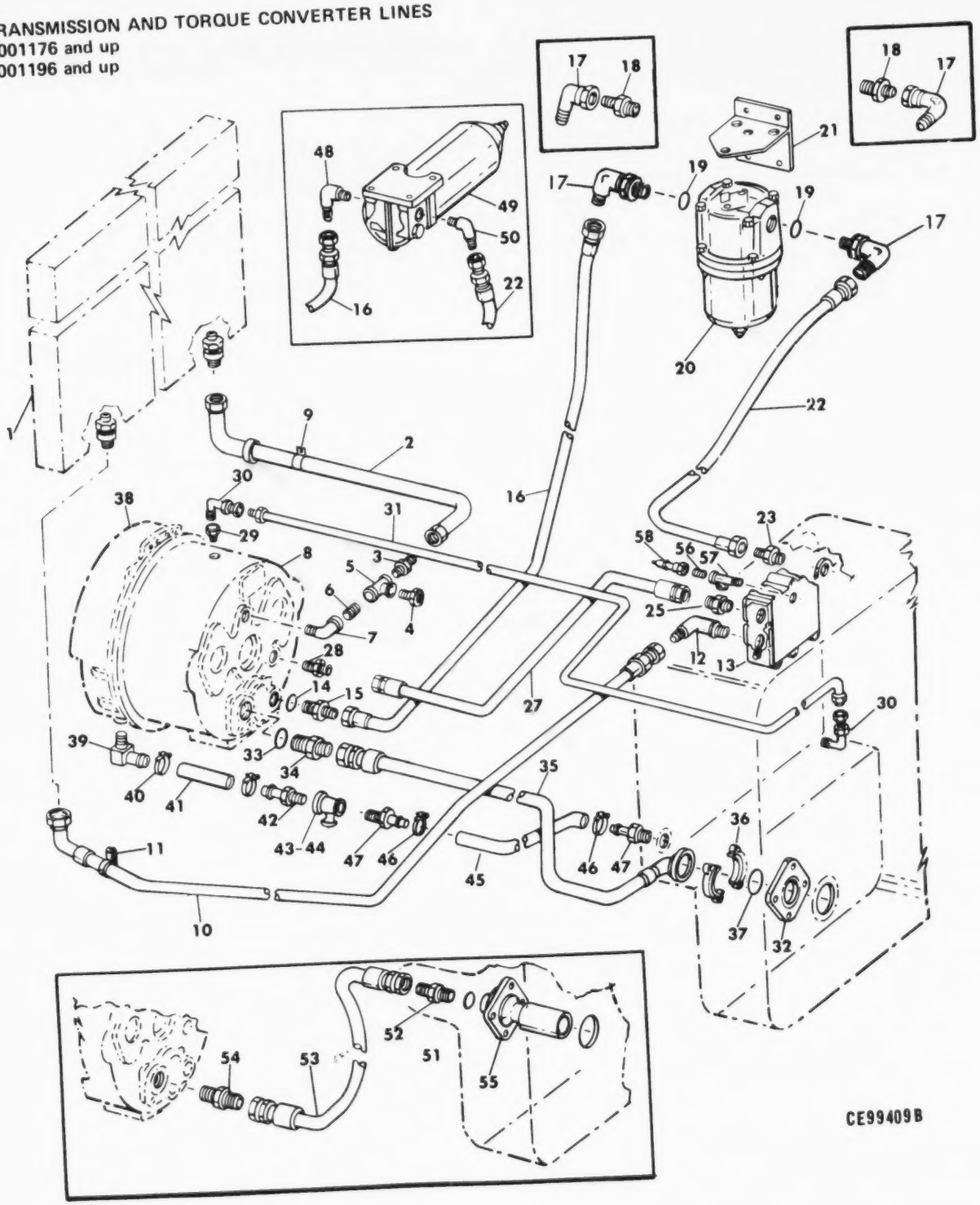
LINE - GAUGE TO VALVE

| | | |
|---|---|---|
| 34 | 891 300 C1 | FITTING, socket (used with Auxiliary Instruments) * |
| 35 | 891 299 C1 | HOSE (Used with Auxiliary Instruments) * |
| 36 | 145 705 H1 | GROMMET (used with Auxiliary Instruments) * |
| 37 | 188 328 H1 | GAUGE, transmission clutch pressure (used with Auxiliary Instruments) * |
| | 117 275 H1 | CLAMP, converter vent to trans. breather (2) |
| | 181 336 | 5/16NF x 3/4" BOLT (2) |
| | 103 320 | 5/16" lock WASHER (2) |
| | 103 025 | 5/16NF hex NUT (2) |
| | 417 199 C2 | TUBE, bulk 3/8" x 50 feet |

* - Also listed and illustrated in Section 11.

MEMORANDA

TRANSMISSION AND TORQUE CONVERTER LINES
U001176 and up
C001196 and up



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TRANSMISSION AND TORQUE CONVERTER LINES - Continued** |
| | | **U001176 and up** |
| | | **C001196 and up** |
| | | **LINE - CONVERTER TO COOLER** |
| 1 | | COOLER, oil (See Oil Cooler in Section 6) |
| 2 | 884 070 C1 | HOSE |
| 3 | 9 402 713 | ADAPTER |
| 4 | 21 113 R1 | BUSHING (Used with ELBOW, 892 495 C1) |
| 5 | 115 237 | TEE (Used with ELBOW, 892 495 C1) |
| 5 | 187 560 | TEE (Used with ELBOW, 108 687) |
| 6 | 127 874 | BUSHING |
| 7 | 892 495 C1 | ELBOW * and below |
| 7 | 108 687 | ELBOW * and up |
| 8 | | HOUSING, torque converter (See Torque Converter in this Section) |
| 9 | 142 846 H1 | CLAMP, hose to frame |
| | 181 315 | BOLT |
| | 106 261 | WASHER, flat |
| | 120 380 | WASHER, lock |
| | 103 024 | NUT |
| | | **LINE - COOLER TO TRANSMISSION** |
| 10 | 884 071 C1 | HOSE, cooler to transmission |
| 11 | 142 846 H1 | CLAMP, hose to frame |
| | 181 315 | BOLT |
| | 106 261 | WASHER, flat |
| | 120 380 | WASHER, lock |
| | 103 024 | NUT |
| 12 | 9 402 869 | ELBOW, 90° |
| 13 | | VALVE, main regulator (See Main Regulator Valve in this Section) |
| | | **LINE - CONVERTER TO FILTER** |
| | | **LINE - FILTER TO MAIN REGULATOR VALVE** |
| 14 | 296 247 R1 | "O" RING |
| 15 | 380 633 R1 | CONNECTOR |
| 16 | 884 137 C1 | HOSE |
| 17 | 9 410 283 | ELBOW (2) U001708 and below C001720 and below |
| 17 | 702 932 C1 | ELBOW (2) U001709 and up C001721 and up |
| | | **LINE - CONVERTER TO FILTER** |
| | | **LINE - FILTER TO MAIN REGULATOR VALVE - Continued** |
| 18 | 875 684 C1 | ADAPTER (2) U001180 to 1708 C001229 to 1720 |
| 19 | 877 691 C1 | "O" RING (2) U001180 and up C001229 and up |
| 20 | | FILTER, converter (See Converter Line Oil Filter in this Section) U001180 and up C001229 and up |
| | 120 384 | WASHER, lock (2) |
| | 24 861 R1 | BOLT (2) |
| 21 | 921 762 C1 | BRACKET U001180 to 1708 C001229 to 1720 |
| 21 | 1 102 124 C1 | BRACKET U001709 and up C001721 and up |
| | 181 339 | BOLT |
| | 615 031 R1 | WASHER, flat (4) |
| | 120 214 | WASHER, lock (4) |
| 22 | 134 151 H1 | HOSE, filter to valve U001180 and up C001229 and up |
| 22 | 132 051 H1 | HOSE, filter to valve U001180 and up C001229 and up |
| 23 | 606 367 C1 | CONNECTOR |
| | | **LINE - CONTROL VALVE TO CONVERTER** |
| 25 | 9 402 711 | CONNECTOR |
| 27 | 884 135 C1 | HOSE, valve to converter |
| 28 | 606 367 C1 | CONNECTOR |
| | | **LINE - CONVERTER VENT TO TRANSMISSION BREATHER** |
| 29 | 144 048 | BUSHING, reducer |
| 30 | 42 411 D | ELBOW w/o NUT (2) |
| | 414 505 C1 | INSERT |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**TRANSMISSION AND TORQUE CONVERTER LINES - Continued**
**U001176 and up**
**C001196 and up**

**LINE - CONVERTER VENT TO TRANSMISSION BREATHER – Continued**

| | | |
|---|---|---|
| 31 | | TUBE w/o NUTS - cut length 3/8 O.D. x 72" long cut from Bulk Tube 417 199 C1 |
| | 37 165 D | NUT, tube (2) |
| | 117 275 H1 | CLAMP (2) |
| | 181 336 | BOLT (2) |
| | 120 214 | WASHER, lock (2) |
| | 103 025 | NUT (2) |

**LINE - SUCTION, TRANSMISSION TO CONVERTER**

| | | | |
|---|---|---|---|
| 32 | | ADAPTER, filter flange (See Transmission in Section 4) | U001180 and up |
| 33 | 301 016 R1 | "O" RING | U001180 and up |
| 34 | 9 410 209 | ADAPTER | U001180 and up |
| 35 | 924 903 C1 | HOSE | U001180 and up |
| 36 | 300 525 R1 | CLAMP (2) | U001180 and up |
| | 24 862 R1 | BOLT (4) | |
| 37 | 876 077 C1 | "O" RING | U001180 and up |

**DRAIN LINE - FLYWHEEL HOUSING TO TEE**

| | | | |
|---|---|---|---|
| 38 | | HOUSING, flywheel (Refer to EPC-817B Engine Manual) | |
| 39 | 610 612 C1 | ELBOW | |
| 40 | 279 027 R91 | CLAMP (2) | |
| 41 | 327 074 R2 | HOSE | |
| 42 | 196 274 H1 | ADAPTER, straight | |

**DRAIN LINE - CONVERTER TO TRANSMISSION**

| | | | |
|---|---|---|---|
| 43 | 186 553 | TEE | |
| 44 | 191 492 | NIPPLE | |
| 45 | | HOSE (cut length 1-1/2"ID x 23" long) (Cut from bulk hose, 313 247 R1) | |
| 46 | 279 027 R91 | CLAMP (2) | |
| 47 | 921 206 C1 | ADAPTER, straight | |
| 47A | 921 205 C1 | ELBOW | |

**LINE - CONVERTER TO FILTER**
**LINE - FILTER TO MAIN REGULATOR VALVE**

| | | | |
|---|---|---|---|
| 48 | 9 402 867 | ELBOW, 90° | U001176 thru 01179 C00* and below |
| 49 | | FILTER, converter line oil (See (Converter Line Oil Filter in this Section) | U001176 thru 01179 C00* and below |
| | 181 340 | BOLT, 5/16NF x 1-1/8" (4) | |
| | 615 031 R1 | WASHER, 5/16" flat (4) | |
| | 103 320 | WASHER, 5/16" lock (4) | |
| | 103 025 | NUT, 5/16"NF hex (4) | |
| 50 | 9 402 828 | ELBOW, 45° | U001176 thru 01179 C00* and below |

**LINE - SUCTION, TRANSMISSION TO CONVERTER**

| | | | |
|---|---|---|---|
| 51 | 296 247 R1 | "O" RING | U001176 thru 01179 C00* thru 01228 |
| 52 | 9 410 207 | ADAPTER | U001176 thru 01179 C00* thru 01228 |

* - Serial number not available


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| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

TRANSMISSION AND TORQUE CONVERTER LINES - Continued
U001176 and up
C001196 and up

LINE - SUCTION, TRANSMISSION TO CONVERTER

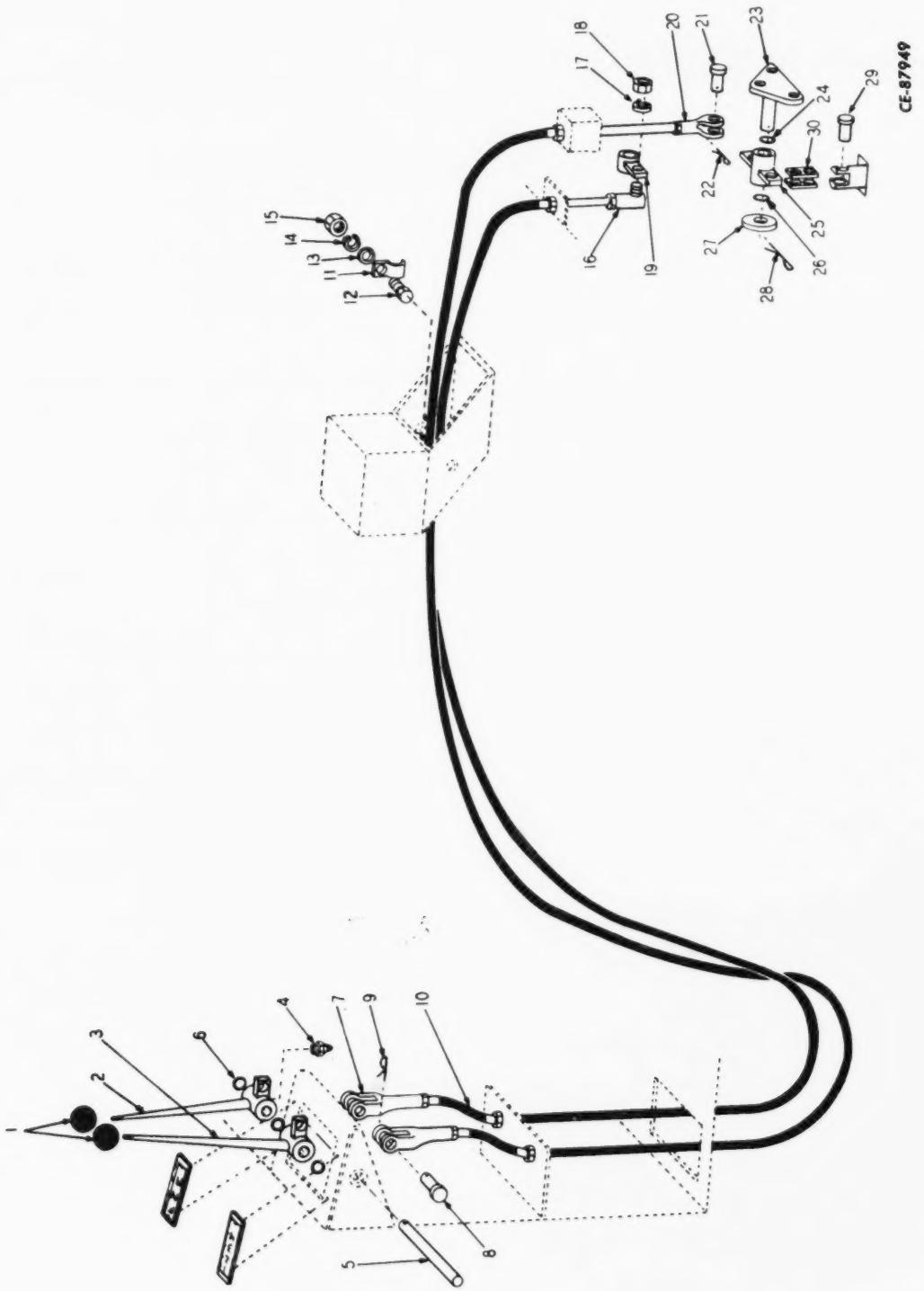
| | | | |
|---|---|---|---|
| 53 | 884 134 C1 | HOSE | U001176 thru 01179<br>C00* thru 01228 |
| 54 | 9 402 713 | CONNECTOR | U001176 thru 01179<br>C00* thru 01228 |
| 55 | | FILTER, oil (See Transmission in this Section) | |

QUICK CONNECTIVE

| | | |
|---|---|---|
| 56 | 105 404 | NIPPLE |
| 57 | 113 169 H1 | TEE |
| 58 | 342 775 R91 | CAP, quick connective |
| | 417 199 C1 | TUBE, 3/8" O.D. x 50 feet long |
| | 313 247 R1 | HOSE, bulk 1-1/2" I.D. x 15 ft. (#) (x) |

* - Serial number not available.
(#) - Part number and price covers one foot of bulk item.
x - As required.

## TRANSMISSION CONTROL GEARSHIFT LINKAGE



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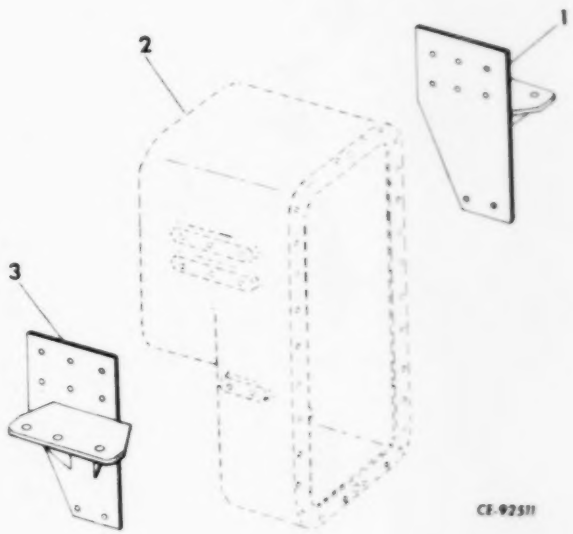
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TRANSMISSION CONTROL GEARSHIFT LINKAGE - Continued** |
| 1 | HL-3343 | KNOB (2) |
| 2 | 214 111 H1 | LEVER, forward and reverse w/two BUSHING, 144 244 H1 |
| 3 | 214 113 H1 | LEVER, range w/two BUSHING, 144 244 H1 |
| 4 | | NOT USED |
| 5 | 213 835 H1 | PIN |
| | 181 348 | 5/16NF x 2-1/4" BOLT |
| | 19 503 R1 | 5/16-24NF Esna NUT |
| 6 | 293 739 R1 | "O" RING (4) |
| 7 | 104 037 | YOKE, end - 5/16 (2) |
| 8 | 114 784 | CLEVIS (2) |
| 9 | 103 374 | PIN, cotter (2) |
| 10 | 213 356 H1 | CABLE, control (2) |
| 11 | 143 142 H1 | CLAMP, fitted to front hydraulic manifold (2) |
| 12 | 181 339 | BOLT, 5/16NF x 1" (2) |
| 13 | 25 543 R1 | WASHER, flat (2) |
| 14 | 120 214 | WASHER, lock (2) |
| 15 | 103 025 | NUT (2) |
| 16 | 158 396 H1 | BALL JOINT, range shift |
| 17 | 120 214 | WASHER, lock |
| 18 | 103 025 | NUT, 5/16"NF hex |
| 19 | 214 188 H1 | LEVER |
| 20 | 104 037 | YOKE, end - forward and reverse shift - 5/16 |
| 21 | 114 784 | CLEVIS |
| 22 | 103 374 | PIN, cotter |
| 23 | 214 198 H1 | SUPPORT, bellcrank mounting |
| | 24 842 R1 | BOLT (3) |
| | 214 192 H1 | SPACER |
| 24 | 307 915 R1 | "O"RING, between support and bellcrank |
| 25 | 214 193 H1 | BELLCRANK, w/two BUSHING 144 244 H1 |
| 26 | 307 915 R1 | "O" RING, between flatwasher and bellcrank |
| 27 | 103 348 | WASHER, flat - 1 (X) |
| 28 | 103 397 | PIN, cotter - 5/32 x 1-1/4" |
| 29 | 114 787 | CLEVIS (2) |
| | 103 375 | PIN, cotter (2) |
| 30 | 153 996 H1 | LINK (2) |
| | 144 244 H1 | BUSHING (6) |

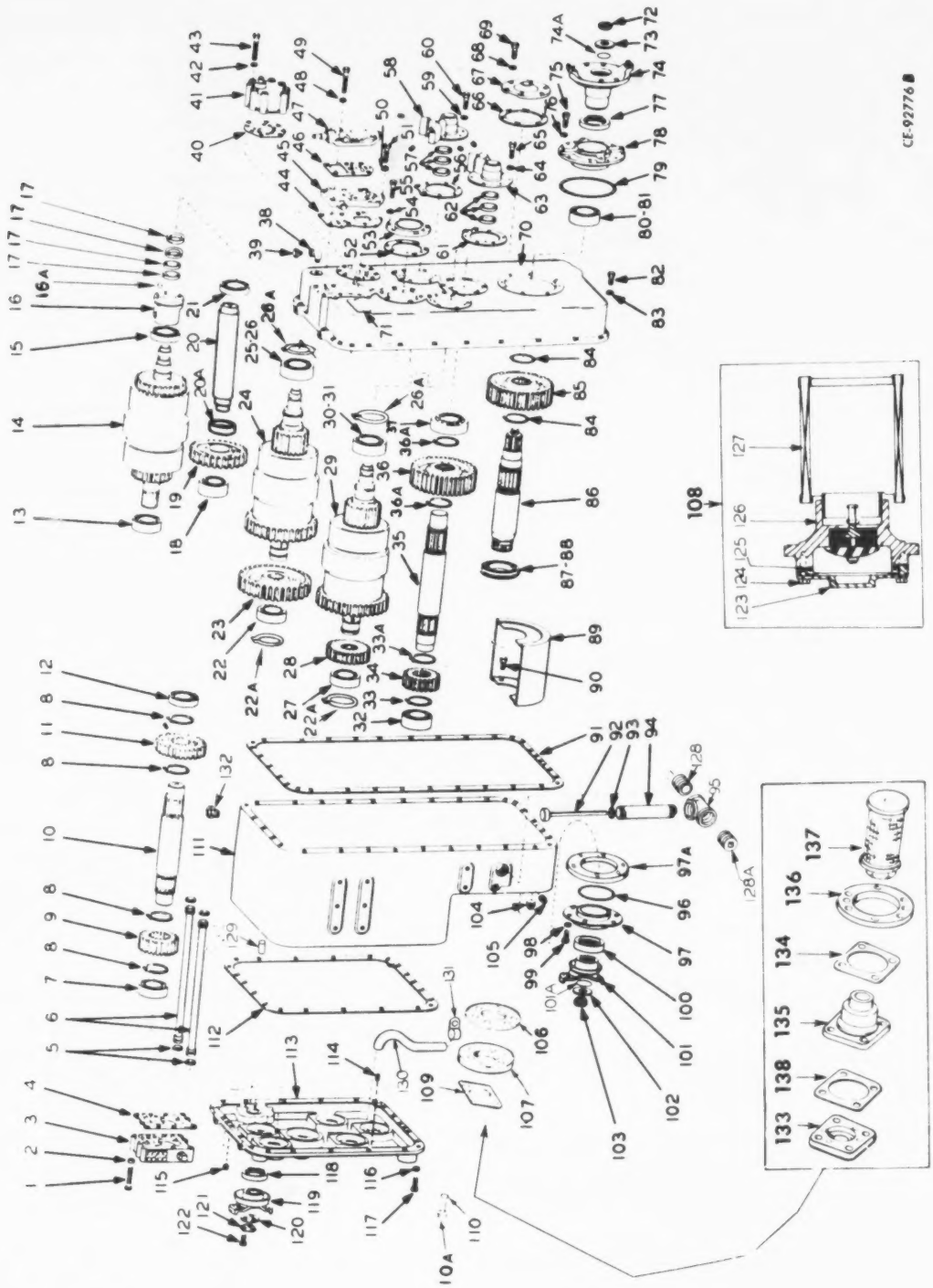
**TRANSMISSION MOUNTING**




| | | |
|---|---|---|
| 1 | 884 015 C1 | SUPPORT, L.H. transmission mounting |
| | 24 897 R1 | BOLT, 3" long (3) |
| | 24 874 R1 | BOLT, 1-3/4" long (8) |
| | 25 557 R1 | WASHER, 3/4" flat (6) |
| | 25 537 R1 | WASHER, 5/8" lock (8) |
| | 9 413 983 | NUT (3) |
| 2 | | TRANSMISSION (See Transmission in this section) |
| 3 | 884 016 C1 | SUPPORT, R.H. transmission mounting |
| | 24 892 R1 | BOLT, 3" long (3) |
| | 24 874 R1 | BOLT, 1-3/4" long (8) |
| | 25 557 R1 | WASHER, 3/4" flat (6) |
| | 25 537 R1 | WASHER, 5/8" lock (8) |
| | 9 413 983 | NUT (3) |

(X) - As Required.

## TRANSMISSION



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TRANSMISSION - Continued

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 878 225 C95 | TRANSMISSION (P-2004) U001179 and below C001228 and below |
| | | (Order the following - |
| | | 1 TRANSMISSION 894 117 C92 |
| | | 1 "O" RING 876 007 C1 |
| | | 2 CLAMPS 215 014 H1 |
| | | 4 BOLT 894 921 C1 |
| | | 1 HOSE 924 903 C1 |
| | | 1 ADAPTER 9 410 209 |
| | | 1 "O" RING 301 016 R1 |
| | | 1 ADAPTER 380 633 R1 |
| | | 1 "O" RING 296 247 R1 |
| | | 1 PUMP 921 806 C1) |
| | 894 117 C92 | TRANSMISSION (P-2004) U001180 and up C001229 and up |
| 1 | 179 851 | BOLT, 3/8NC x 3" (11) |
| 2 | 103 321 | WASHER, 3/8" lock (11) |
| 3 | | VALVE, main regulator (See Main Regulator Valve in this Section) |
| 4 | | SOCKET (See Main Regulator Valve in this Section) |
| 5 | 254 954 R1 | "O" RING, (%) (4) |
| 6 | 191 122 H1 | TUBE, oil transfer (2) |
| 7 | 659 347 R91 | BEARING |
| 8 | 324 738 R1 | RING, retaining (4) |
| 9 | 213 336 H1 | GEAR, 19T |
| 10 | 156 377 H1 | SHAFT, reverse idler |
| 11 | 213 337 H1 | GEAR, 25T |
| 12 | 613 690 C91 | BEARING |
| 13 | 883 317 C91 | BEARING |
| 14 | | CLUTCH PACK, forward and reverse (See Clutch Group forward and reverse in this Section) |
| 15 | 613 690 C91 | BEARING |
| 16 | 156 341 H1 | COVER w/DOWEL PIN 159 897 H1 |
| 16A | 159 845 H1 | PIN, dowel |
| 17 | 878 116 C1 | RING, seal (%) (4) |
| 18 | 156 901 H1 | BEARING |
| 19 | 213 320 H1 | GEAR, main idler, 29T |
| 20 | 877 603 C1 | SHAFT, main idler |
| 20A | 877 602 C1 | SPACER |
| 21 | ST-265 | BEARING |
| 22 | 659 347 R1 | BEARING |
| 22A | 300 026 R1 | RING, snap (2) |
| 23 | 213 323 H2 | GEAR, 38T |
| 24 | | CLUTCH PACK (See Clutch Group 1st and 3rd, 2nd and 4th in this Section) |
| 25 | 291 841 R91 | BEARING, race and rollers |
| 26 | 174 346 H1 | BEARING, inner race |
| 26A | 114 349 H1 | RING, snap (2) |
| 27 | 659 347 R91 | BEARING |
| 28 | 213 319 H1 | GEAR, 21T |
| 29 | | CLUTCH PACK (See Clutch Group 1st and 3rd, 2nd and 4th in this Section) |
| 30 | 291 841 R91 | BEARING, race and rollers |
| 31 | 174 346 H1 | BEARING, inner race |
| 32 | 659 347 R91 | BEARING |
| 33 | 214 876 H1 | SPACER |
| 33A | 214 877 H1 | SPACER |
| 34 | 213 318 H1 | GEAR, 17T |
| 35 | 214 878 H1 | SHAFT, gather |
| 36 | 213 321 H1 | GEAR, 33T |
| 36A | 324 738 R1 | RING (2) |
| 37 | 156 878 H1 | BEARING |
| 38 | 444 258 | TEE |
| 39 | 131 586 H1 | BREATHER |
| 40 | | GASKET (See Range Selector Valve in this Section) |
| 41 | | VALVE, range selector (See Selector Valve in this Section) |
| 42 | 103 320 | WASHER, 5/16" lock (8) |

(%) Also part of KIT 875 492 C92

TRANSMISSION - Continued

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 43 | 179 830 | BOLT, 5/16NC x 3 (8) |
| 44 | | GASKET (See Neutral Knockdown Valve in this Section) |
| 45 | | VALVE, neutral knockdown (See Neutral Knockdown Valve in this Section) |
| 46 | | GASKET (See Forward and Reverse Valve in this Section) |
| 47 | | VALVE, forward and reverse (See Forward and Reverse Valve in this Section) |
| 48 | 103 321 | WASHER, 3/8 lock (6) |
| 49 | 179 851 | BOLT, 3/8NC x 3" (6) |
| 50 | 103 321 | WASHER, 3/8" lock (3) |
| 51 | 179 840 | BOLT, 3/8NC x 1-1/8" (3) |
| 52 | 156 257 H1 | GASKET (≠) |
| 53 | 156 375 H1 | RETAINER, bearing |
| 54 | 103 321 | WASHER, 3/8" lock (6) |
| 55 | 179 840 | BOLT, 3/8NC x 1-1/8" (6) |
| 56 | 156 330 H1 | GASKET (≠) |
| 57 | 878 116 C1 | RING, seal (%) (4) |
| 58 | 878 108 C1 | COVER |
| 59 | 103 321 | WASHER, 3/8" lock (6) |
| 60 | 179 840 | BOLT, 3/8NC x 1-1/8" (6) |
| 61 | 156 330 H1 | GASKET (≠) |
| 62 | 878 116 C1 | RING, seal (%) (4) |
| 63 | 878 108 C1 | COVER |
| 64 | 103 321 | WASHER, 3/8" lock (6) |
| 65 | 179 840 | BOLT, 3/8NC x 1-1/8" (6) |
| 66 | 156 367 H1 | GASKET (≠) |
| 67 | 878 109 C1 | RETAINER, bearing |
| 68 | 103 321 | WASHER, 3/8" lock (6) |
| 69 | 179 839 | BOLT, 3/8NC x 1" (6) |
| 70 | | COVER, rear (For components see Rear Cover in this Section) |
| 71 | 887 529 C1<br>123 250 H1 | PLATE, name<br>SCREW, plate (2) |
| 72 | 215 617 R1 | NUT, self-locking |
| 73 | 194 293 H1 | RETAINER |
| 74 | 194 279 H2 | YOKE |
| 74A | 702 283 R1 | GASKET, yoke (≠) |
| 75 | 179 839 | BOLT, 3/8NC x 1" (8) |
| 76 | 103 321 | WASHER, 3/8" lock (8) |
| 77 | 194 292 H1 | SEAL, oil (*) |
| 78 | 875 479 C1 | RETAINER |
| 79 | 22 417 R1 | "O" RING (%) |
| 80 | 875 453 C91 | CONE |
| 81 | 104 577 H1 | CUP |
| 82 | 179 841 | BOLT, 3/8NC x 1-1/4" (29) |
| 83 | 103 321 | WASHER, 3/8" lock (29) |
| 84 | 324 738 R1 | RING, retaining (2) |
| 85 | 213 322 H1 | GEAR, 34T |
| 86 | 875 482 C2 | SHAFT, output |
| 87 | 875 453 C91 | CONE |
| 88 | 104 577 H1 | CUP |
| 89 | 156 305 H1 | BAFFLE, oil |
| 90 | 156 894 H1 | SCREW, cap (3) |
| 91 | 156 329 H1 | GASKET, rear cover (≠) |
| 92 | 154 090 H1 | DIPSTICK |
| 93 | 134 045 H1 | SEAL (*) |
| 94 | 154 092 H2 | PIPE |
| 95 | 144 081 | TEE |
| 96 | 22 285 R1 | "O" RING (%) |
| 97 | 875 480 C1 | RETAINER |
| 97A | 875 476 C1 | SHIM, retainer - .004" |
| 97A | 875 477 C1 | SHIM, retainer - .007" |

(≠) - Also part of KIT 195 559 H2
(*) - Also part of KIT 195 558 H2
(%) - Also part of KIT 875 492 C92



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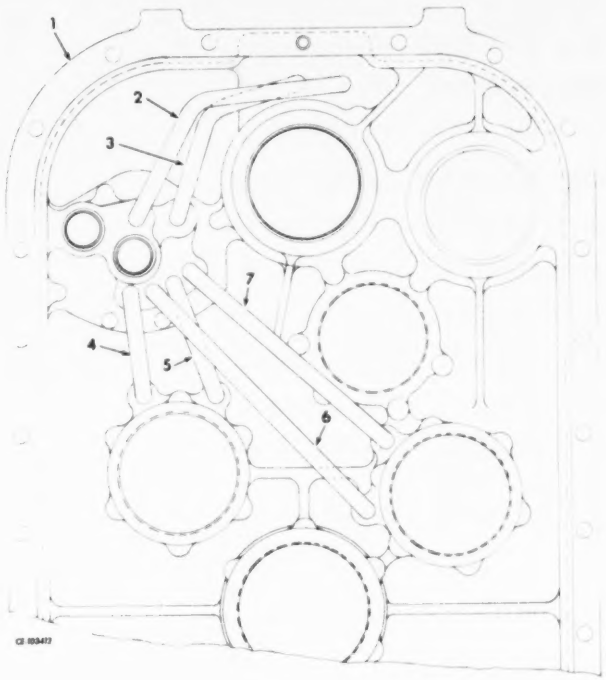
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **TRANSMISSION - Continued** | | |
| 97A | 875 478 C1 | SHIM, retainer - .020" |
| 98 | 103 321 | WASHER, 3/8" lock (6) |
| 99 | 179 839 | BOLT, 3/8NC x 1" (6) |
| 100 | 194 292 H1 | SEAL, oil (*) |
| 101 | 194 279 H2 | YOKE |
| 101A | 702 283 R1 | GASKET, yoke (≠) |
| 102 | 194 293 H1 | RETAINER |
| 103 | 215 617 R1 | NUT, stop |
| 104 | 20 969 R1 | PLUG, pipe 3/4" |
| 105 | 445 686 | PLUG, pipe 3/8" |
| 106 | 927 534 C1 | GASKET, retainer (≠) |
| 107 | 877 588 C1<br>379 446 R1 | RETAINER, filter<br>BOLT (4) |
| 108 | 214 187 H1 | FILTER, oil<br>U001179 and below<br>C001228 and below |
| 109 | 169 206 H1 | GASKET, filter<br>U001179 and below<br>C001228 and below |
| 110 | 103 323 | WASHER, lock 1/2" (4) |
| 110 A | 179 883 | BOLT, 1/2NC x 1-1/4" (4)<br>U001179 and below<br>C001228 and below |
| 111 | 162 408 H1 | HOUSING |
| 112 | 156 398 H1 | GASKET, front cover (≠) |
| 113 | 883 174 C1 | COVER, front |
| 114 | 444 709 | PLUG, pipe 3/4" (2) |
| 115 | 444 600 | PLUG, pipe 1" |
| 116 | 103 321 | WASHER, 3/8" lock (20) |
| 117 | 179 481 | BOLT, 3/8NC x 1-1/4" (20) |
| 118 | 333 996 R92 | SEAL, oil (*) |
| 119 | 159 900 H1 | FLANGE, input |
| 120 | 156 361 H1 | WASHER, retainer |
| 121 | 156 362 H1 | PLATE, locking |
| 122 | 179 838 | BOLT, 3/8NC x 7/8" (3) |
| 123 | 220 843 H1 | FLANGE |
| 124 | 876 428 C91 | SCREW, cap (4) |
| 125 | 285 723 R1 | "O" RING |
| 126 | 220 844 H1 | VALVE |
| 127 | 220 845 H1 | ELEMENT |
| 128 | 219 358 | NIPPLE |
| 128A | 20 970 R1 | PIPE, plug 1-1/4" |
| 129 | 148 880 H1 | DOWEL (4) |
| 130 | 160 265 H1 | TUBE |
| 131 | 160 266 H1<br>875 907 C1 | CLAMP<br>5/16DH x 1-1/2" BOLT WIRE, locking (16 ga. x 6" long) (Cut from bulk WIRE, 278 025 R1) |
| 132 | 878 194 C1 | ADAPTER, pick up to cover |
| 133 | 894 904 C1 | ADAPTER, flange<br>U001180 and up<br>C001229 and up |
| | 21 456 R1<br>103 323 | BOLT, (4)<br>WASHER, 1/2" lock (4) |
| 134 | 169 206 H2 | GASKET, filter (≠)<br>U001180 and up<br>C001229 and up |
| 135 | 896 556 C2 | VALVE, check<br>U001180 and up<br>C001229 and up |
| 136 | 877 588 C1 | RETAINER, filter<br>U001180 and up<br>C001229 and up |

(≠) - Also part of KIT 195 559 H2
(*) - Also part of KIT 195 558 H2
(%) - Also part of KIT 875 492 C92

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | TRANSMISSION - Continued |
| 137 | 921 574 C2 | STRAINER, filter<br>U001180 and up<br>C001229 and up |
| 138 | 930 331 C1 | GASKET<br>U001180 and up<br>C001229 and up |
| | 352 221 R1 | "O" RING (Clutch Pack Cover) (%) (4) |
| | 355 967 R1 | "O" RING (Between Clutch Shaft Oil Supply Cap and Rear Main Housing) |
| | 876 783 C91 | RETAINER 875 480 C1 w/CUP 104 577 H1 and OIL SEAL 194 292 H1 |
| | 876 782 C91 | RETAINER 875 479 C1 w/CUP 104 577 H1 and OIL SEAL 194 292 H1 |
| | 278 027 R1 | WIRE, bulk locking (16 ga. x 50 ft) |

(%) - Also part of KIT 875 492 C92

TRANSMISSION REAR COVER




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 156 328 H6 | COVER, rear<br>(Consists of the following parts - |
| 1 | | COVER (Not furnished separately) |
| 2 | 159 881 H2 | TUBE, forward and reverse main |
| 3 | 159 882 H2 | TUBE, forward and reverse lube |
| 4 | 159 854 H2 | TUBE, first |
| 5 | 159 859 H2 | TUBE, third |
| 6 | 160 004 H2 | TUBE, second |
| 7 | 159 864 H2 | TUBE, fourth |



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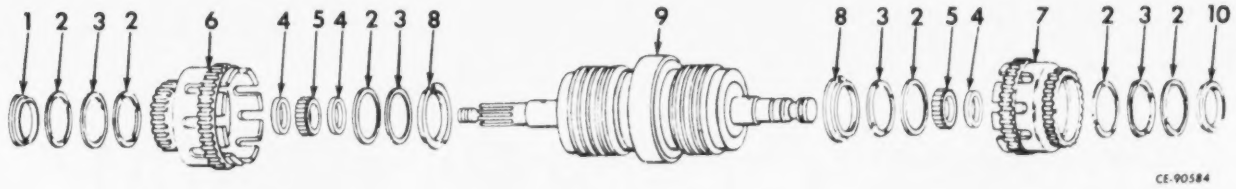
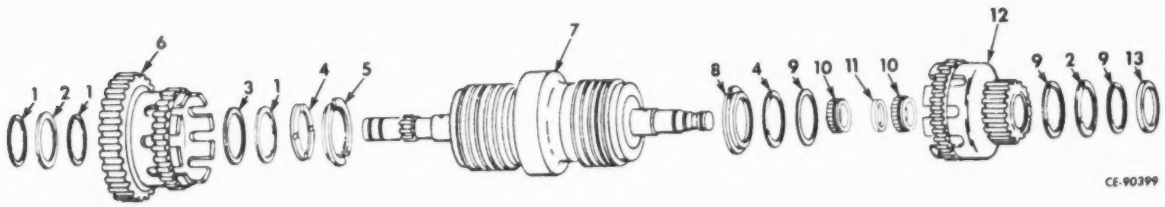
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

## CLUTCH GROUP (FORWARD AND REVERSE)




| | | | | | |
|---|---|---|---|---|---|
| 1 | 883 313 C1 | SPACER | 7 | 212 832 H1 | GEAR |
| 2 | 156 899 H1 | SPACER (6) | 8 | 163 458 H2 | SPACER (2) |
| 3 | 156 324 H1 | WASHER, thrust (4) | 9 | | CLUTCH ASSEMBLY, forward and reverse (See Basic Clutch Pack in this Section) |
| 4 | 216 957 H1 | SPACER (3) | | | |
| 5 | 324 490 R91 | BEARING (2) | 10 | 157 033 H1 | SPACER |
| 6 | 212 834 H1 | GEAR | 11 | 287 049 R1 | SNAPRING, external |




## CLUTCH GROUP (1st AND 3rd, 2nd AND 4th)

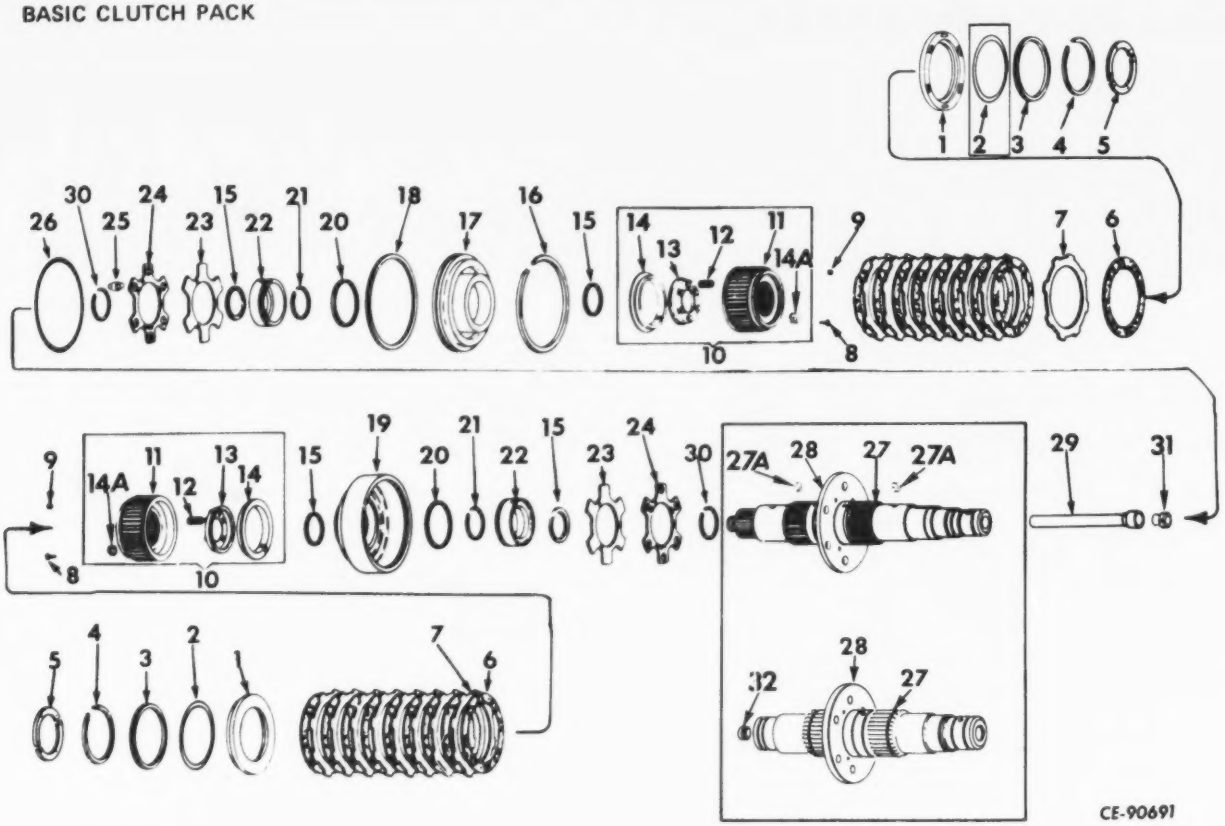
CLUTCH GROUP (1st and 3rd) (Includes items 1 thru 13)

CLUTCH GROUP (2nd and 4th) (Includes items 1 thru 13)

| | | | | | |
|---|---|---|---|---|---|
| 1 | 216 929 H1 | SPACER (3) | 7 | | CLUTCH ASSY (See Basic Clutch Pack, 1st and 3rd, 2nd and 4th in this Section) |
| 2 | 216 930 H1 | WASHER, thrust (2) | 8 | 216 927 H1 | SPACER |
| 3 | 216 932 H1 | BEARING | 9 | 216 931 H1 | SPACER (3) |
| 4 | 324 437 R1 | WASHER, thrust (2) | 10 | 216 933 H1 | BEARING (2) |
| 5 | 216 928 H1 | SPACER | 11 | 216 934 H1 | SPACER |
| 6 | 212 831 H1 | GEAR | 12 | 212 833 H2 | GEAR |
| | | | 13 | 216 935 H1 | SPACER |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

BASIC CLUTCH PACK




| | | |
|---|---|---|
| | 922 909 C91 | CLUTCH PACK ASSEMBLY (forward and reverse) (Consists of items 1 thru 31) |
| | 922 883 C91 | CLUTCH PACK ASSEMBLY (1st and 3rd - 2nd and 4th) (Consists of items 1 thru 32) (2) |
| 1 | 877 623 C1 | PLATE, backing (2)<br>U001277 and below<br>C001251 and below<br>(Order the following parts -<br>1 BACKING PLATE 627 405 C1<br>1 SNAP RING 627 406 C1<br>1 SNAP RING 627 407 C1<br>1 HUB 627 582 C1<br>or<br>1 HUB 922 884 C91) |
| 1 | 627 405 C1 | PLATE, backing (2)<br>U001278 and up<br>C001252 and up |
| 2 | | NOT USED |
| 3 | 324 469 R1 | RING, snap (internal) (2)<br>U001277 and below<br>C001251 and below |
| 3 | 627 407 C1 | RING, snap (internal) (2)<br>U001278 and up<br>C001252 and up |
| 4 | 877 625 C1 | RING, snap (external) (2)<br>U001277 and below<br>C001251 and below |
| 4 | 627 406 C1 | RING, snap (external) (2)<br>U001278 and up<br>C001252 and up |
| 5 | 189 340 H2 | RETAINER, clutch (forward and reverse) (4) |
| 5 | 216 946 H1 | RETAINER (1st and 3rd, 2nd and 4th) (4) |
| 6 | 702 874 C1 | PLATE, internal spline clutch (Bronze) (When PLATE, 157 021 H1 is required, order twenty-two PLATE, 702 874 C1)<br>(11) 1st Gear<br>(11) 2nd Gear<br>(11) 3rd Gear<br>(11) 4th Gear<br>(11) Forward<br>(11) Reverse |
| 7 | 156 320 H1 | PLATE, external spline clutch (Steel)<br>(11) 1st Gear<br>(11) 2nd Gear<br>(11) 3rd Gear<br>(11) 4th Gear<br>(11) Forward<br>(11) Reverse |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BASIC CLUTCH PACK - Continued** |
| 8 | 189 339 H1 | BOLT, 5/16" - 18 x .406 special (4) |
| 9 | 327 178 R1 | PIN, dowel (2)<br>U001277 and below<br>C001251 and below |
| 10 | 877 622 C91 | CLUTCH HUB ASSEMBLY (forward and reverse) (2)<br>U001277 and below<br>C001251 and below<br>(Order the following parts -<br>1 HUB 627 582 C1<br>1 PLATE BACKING 627 405 C1<br>1 SNAP RING 627 406 C1<br>1 SNAP RING 627 407 C1) |
| 10 | 627 582 C1 | CLUTCH HUB ASSEMBLY (forward and reverse) (2)<br>U001278 and up<br>C001252 and up |
| 10 | 877 620 C91 | CLUTCH HUB ASSEMBLY (1st and 3rd, 2nd and 4th) (2)<br>U001277 and below<br>C001251 and below<br>(Order the following parts -<br>1 HUB 922 884 C91<br>1 PLATE BACKING 627 405 C1<br>1 SNAP RING 627 406 C1<br>1 SNAP RING 627 407 C1 |
| 10 | 922 884 C91 | CLUTCH HUB ASSEMBLY (1st and 3rd, 2nd and 4th) (2)<br>U001278 and up<br>C001252 and up |
| 11 | | HUB, clutch (Not Furnished Separately) (2) |
| 12 | | SPRING (Not furnished separately) (18) |
| 13 | | RETAINER, spring (Not furnished separately) (2) |
| 14 | | RETAINER, plate (Not furnished separately) (2) |
| 14A | 17 143 R1 | PIN |
| 15 | 324 489 R3 | SEAL, ring (forward and reverse) (**) (4) |
| 15 | 216 938 H1 | SEAL, ring (1st and 3rd, 2nd and 4th) (##) (4) |
| 16 | 156 897 H1 | RING, internal |
| 17 | 156 316 H1 | PISTON, clutch (forward and reverse) |
| 17 | 216 943 H1 | PISTON, clutch (1st and 3rd, 2nd and 4th) |
| 18 | 157 255 H1 | SEAL (**) (##) (%) |
| 19 | 156 317 H1 | HOUSING, piston (forward and reverse) |
| 19 | 216 944 H1 | HOUSING, piston (1st and 3rd, 2nd and 4th) |
| 20 | 324 488 R2 | RING, seal (forward and reverse) (**) (2) |
| 20 | 216 942 H1 | RING, seal (1st and 3rd, 2nd and 4th) (##) (2) |
| 21 | 156 896 H1 | RING, external snap (forward and reverse) (2) |
| 21 | 220 646 H1 | RING, external snap (1st and 3rd, 2nd and 4th) (#) (2) |
| 22 | 338 500 R1 | PISTON, accelerating (forward and reverse) (2) |
| 22 | 216 941 H1 | PISTON, accelerating (1st and 3rd, 2nd and 4th) (2) |
| 23 | 163 425 H1 | VALVE, disc (forward and reverse) (2) |
| 23 | 216 939 H1 | VALVE, disc (1st and 3rd, 2nd and 4th) (#) (2) |
| 24 | 216 960 H1 | DISC, reinforcing (forward and reverse) (2) |
| 24 | 216 940 H1 | DISC, reinforcing (1st and 3rd, 2nd and 4th) (2) (#) |
| 25 | 610 485 C1 | PIN, dowel (#) (3) |
| 26 | 610 418 C1 | RING, seal (**) (##) (%) |
| 27 | 216 959 H1 | SHAFT ASSEMBLY (forward and reverse)(Includes items 27A thru 31) |
| 27 | 216 937 H1 | SHAFT ASSEMBLY (1st and 3rd, 2nd and 4th)(Includes items 28 thru 32) |
| 27A | 153 336 H1 | PIN, spring (Used with SHAFT 216 959 H1) (2) |
| 28 | | PLATE, separator (#) |
| 29 | | TUBE (Not furnished separately) |
| 30 | 156 896 H1 | RING, snap (forward and reverse)(2) |
| 30 | 220 646 H1 | RING, snap (1st and 3rd, 2nd and 4th) (#) (2) |

(%) - Also part of KIT, 875 492 C92
(**) - Also part of KIT, 198 286 H1
(#) - Also part of KIT, 938 574 C1
(##) - Also part of KIT, 882 346 C91

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| BASIC CLUTCH PACK - Continued | | |
| 31 | 163 418 H1 | PLATE, oil inlet |
| 32 | 194 363 H2 | PLUG, pipe 1/2" - 14 (1st and 3rd, 2nd and 4th) |
| | 198 286 H1 | KIT, seal ring (forward and reverse)<br>(Consists of -<br>1 SEAL, ring 610 418 R1<br>1 SEAL, ring 157 255 H1<br>2 SEAL, ring 156 315 H1<br>4 SEAL, ring 209 743 H1) |
| | 882 346 C91 | KIT, seal ring (1st and 3rd, 2nd and 4th)<br>(Consists of -<br>1 SEAL, ring 610 418 R1<br>1 SEAL, ring 157 255 H1<br>4 SEAL, ring 216 938 H1<br>2 SEAL, ring 216 942 H1) |
| | 938 574 C1 | KIT, clutch separator plate (1st and 3rd, 2nd and 4th)<br>(Consists of -<br>2 DISC, reinforcing 216 940 H1<br>3 PIN, dowel 610 485 C1<br>§ 1 PLATE, separator<br>4 RING, snap 220 646 H1<br>2 VALVE, disc 216 939 H1) |

§ - Not Furnished Separately.



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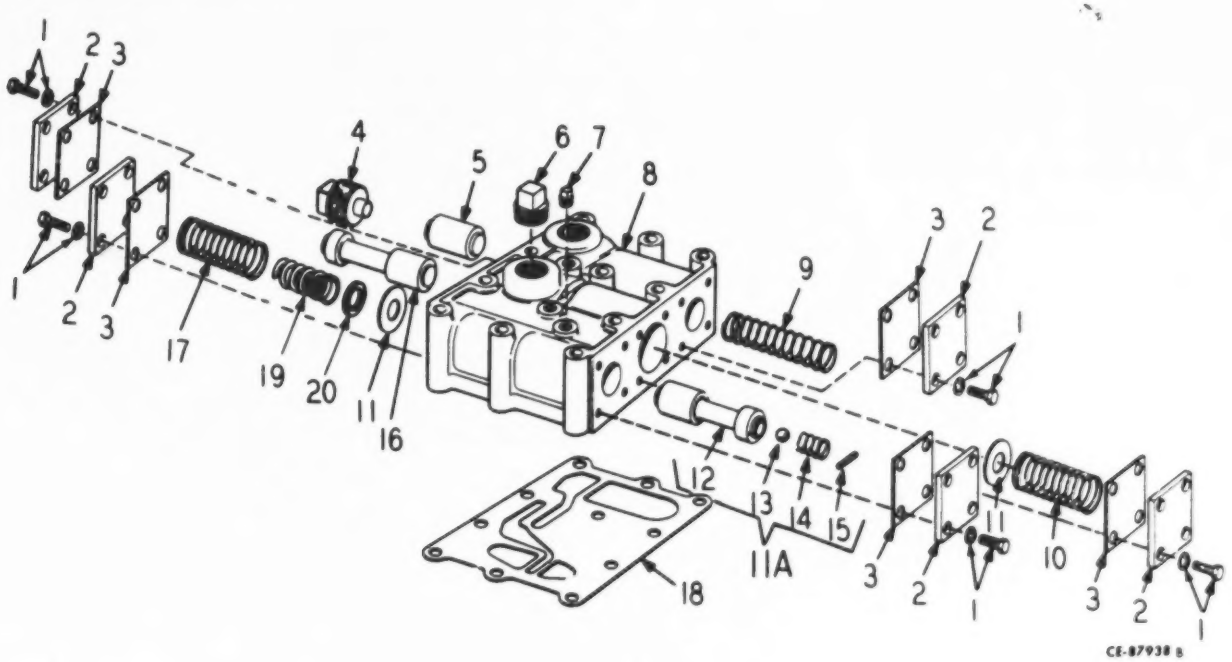
MAIN REGULATOR VALVE



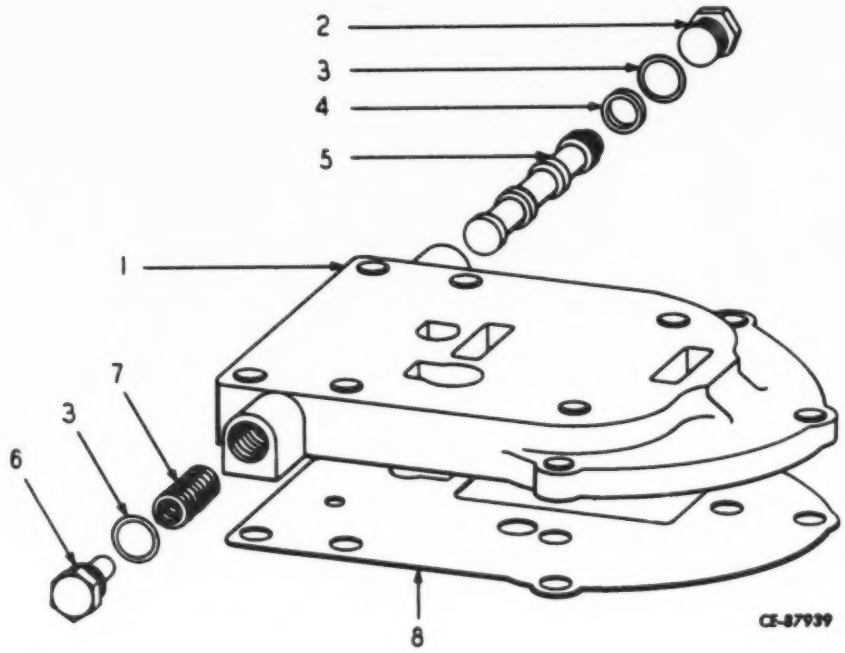

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 148 889 H3 | VALVE, main regulator (Consists of the following - |
| 1 | 189 317 H1 | SCREW & WASHER ASSEMBLY (20) |
| 2 | 321 991 R1 | COVER (5) |
| 3 | 321 992 R1 | GASKET (#) (5) |
| 4 | 149 423 H2 | PLUG |
| 5 | 149 422 H1 | VALVE, lube |
| 6 | 20 969 R1 | PLUG, pipe - 3/4" |
| 7 | 193 488 H1 | PLUG (3) |
| 8 | 148 883 H1 | BODY |
| 9 | 148 830 H1 | SPRING, lube valve |
| 10 | 148 888 H1 | SPRING, by-pass valve |
| 11 | 321 997 R1 | WASHER (X) |
| 11A | 338 651 R94 | VALVE ASSEMBLY |
| 12 | 186 451 H2 | VALVE, main regulator |
| 13 | 186 454 H1 | BALL |
| 14 | 347 243 R1 | SPRING |
| 15 | 190 769 H1 | PIN |
| 16 | 321 998 R1 | VALVE |
| 17 | 324 300 R1 | SPRING, compression |
| 18 | 148 890 H1 | GASKET (#) |
| 19 | 174 653 H2 | SPRING, inner |
| 20 | 606 506 C1 | WASHER, spring (X) |

(#) - Also part of KIT, 195 559 H2

(X) - As Required

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

NEUTRAL KNOCKDOWN VALVE




| | | |
|---|---|---|
| | 156 345 H2 | VALVE, neutral knockdown (Consists of the following parts - |
| 1 | 156 346 H1 | BODY |
| 2 | 157 258 H1 | PLUG |
| 3 | 156 350 H1 | GASKET (#) (2) |
| 4 | 156 348 H1 | SEAL, oil (*) |
| 5 | 156 347 H1 | VALVE |
| 6 | 156 351 H2 | PLUG ASSEMBLY |
| 7 | 156 349 H2 | SPRING |
| 8 | 156 352 H1 | GASKET (#) |

(#) - Also part of KIT 195 559 H2
(*) - Also part of KIT 195 558 H2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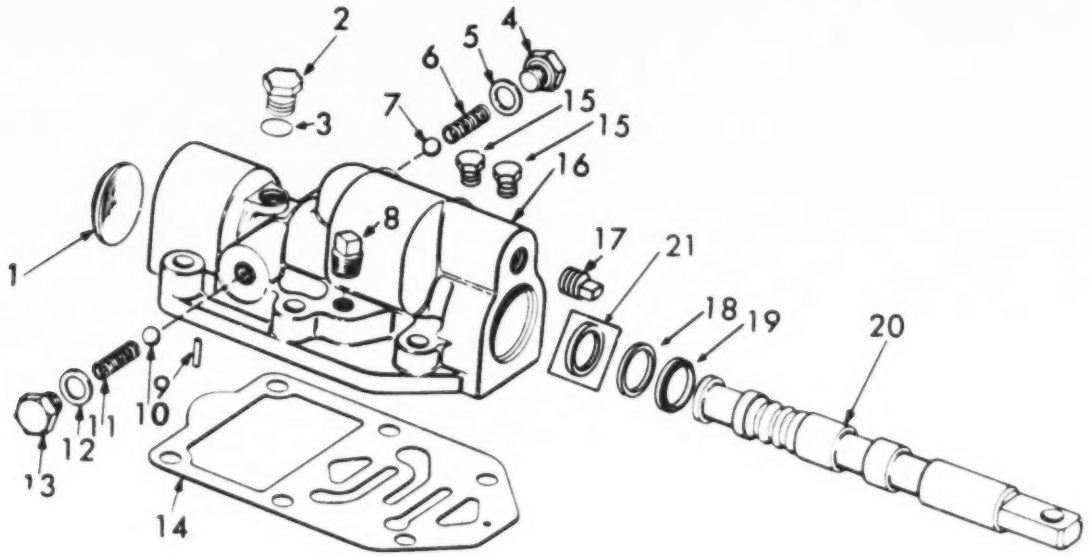
FORWARD AND REVERSE VALVE

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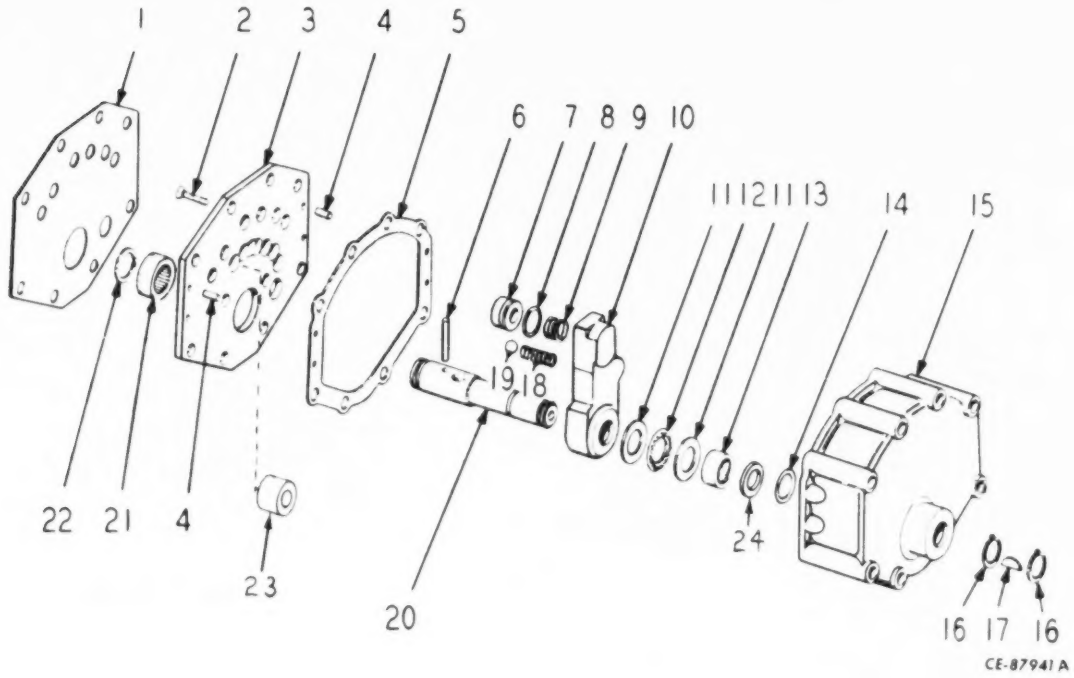
Parts without letters after the description indicates the part is used for both Valves. Letters "A" and "B" are used to identify separate components of Valves.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 875 023 C91 | VALVE (C-309 762) (Order VALVE, 875 023 C92) |
| B | 875 023 C92 | VALVE (C-318 402) (Consists of the following parts - |
| 1 | 172 578 | PLUG, expansion |
| 2 | 9 410 359 | PLUG |
| 3 | 570 828 R1 | "O" RING |
| 4 | 445 078 | PLUG |
| 5 | 149 421 H1 | GASKET (#) |
| 6 | 149 246 H1 | SPRING |
| 7 | 145 587 H1 | BALL |
| 8 | 445 686 | PLUG |
| 9 | 895 268 C1 | PIN, dowel |
| 10 | 145 587 H1 | BALL |
| 11 | 149 246 H1 | SPRING |
| 12 | 149 421 H1 | GASKET (##) |
| 13 | 445 078 | PLUG |
| 14 | 148 833 H1 | GASKET (#) |
| 15 | 444 613 | PLUG (2) |
| 16 | | BODY (Not furnished separately) |
| 17 | 445 686 | PLUG |
| 18 | 1 130 266 C1 | SEAL (Valve B) |
| 19 | 1 130 265 C1 | WIPER (Valve B) |
| 20 | 881 580 C2 | SPOOL |
| 21 | 148 574 H1 | SEAL, oil (Valve A) |

(#) - Also part of KIT, 195 559 H1.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

RANGE SELECTOR VALVE




| | | |
|---|---|---|
| | 207 592 H1 | VALVE, range selector (Order VALVE 892 436 C91) U001064 and below C001002 and up |
| | 892 436 C91 | VALVE, range selector (Consists of the following parts) U001065 and up |
| 1 | 149 224 H1 | GASKET (#) |
| 2 | 113 991 | SCREW |
| 3 | 197 996 H1 | PLATE (Order PLATE 892 481 C1 and VALVE STOP 892 479 C1) U001064 and below C001002 and up |
| 3 | 892 481 C1 | PLATE U001065 and up |
| 4 | 161 349 H1 | PIN, spring (2) |
| 5 | 324 019 R1 | GASKET, cover (#) |
| 6 | 148 857 H1 | PIN, dowel |
| 7 | 324 009 R1 | VALVE, oil inlet |
| 8 | 347 641 R1 | "O" RING (%) |
| 9 | 324 010 R1 | SPRING |
| 10 | 207 593 H1 | VALVE |
| 11 | 148 811 H1 | WASHER, thrust (2) |
| 12 | 324 105 R91 | BEARING, needle thrust |
| 13 | 276 578 R91 | BEARING, needle |
| 14 | 615 851 C1 | SEAL, vee block (*) |
| 15 | 148 808 H1 | COVER |
| 16 | 269 181 R1 | RING, snap (2) |
| 17 | 106 751 | KEY, Woodruff - No. 9 |
| 18 | 149 413 H1 | SPRING |
| 19 | 145 587 H1 | BALL |
| 20 | 148 806 H1 | SHAFT |
| 21 | 10 026 R | BEARING, needle |
| 22 | 324 022 R1 | RING, seal |

(#) - Also part of KIT 195 559 H2
(*) - Also part of KIT 195 558 H2
(%) - Also part of KIT 875 492 C92



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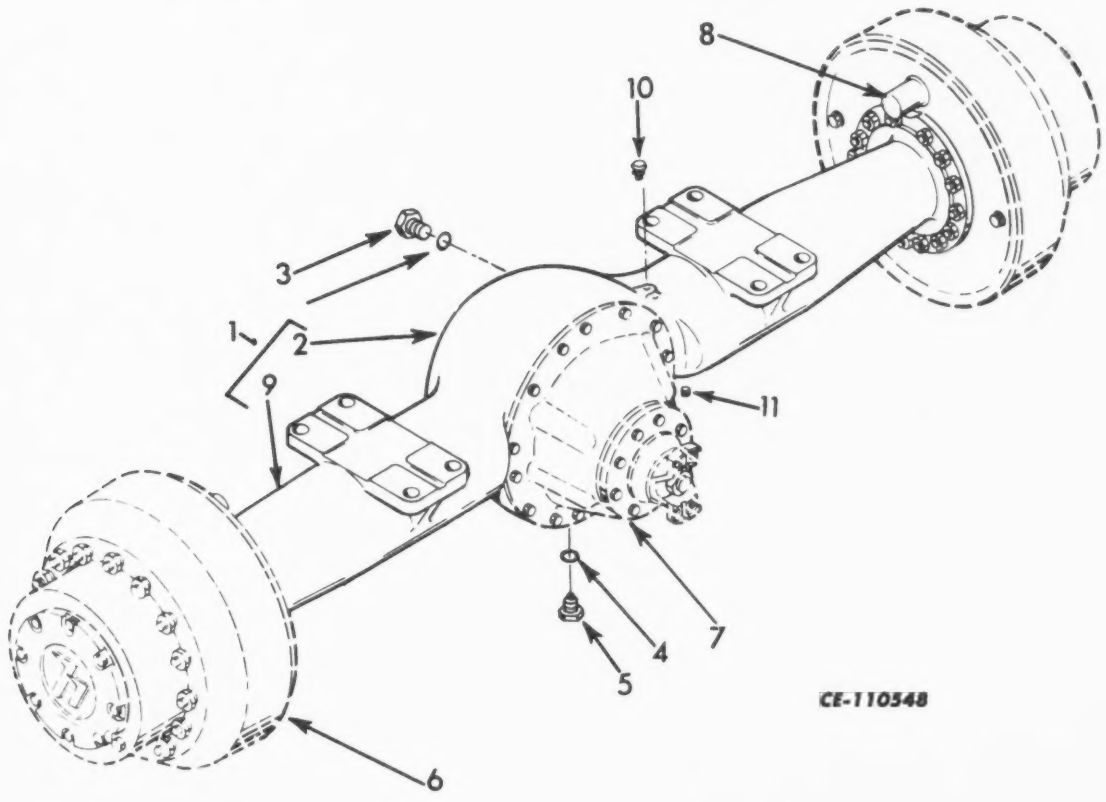
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | RANGE SELECTOR VALVE - Continued |
| 23 | 207 594 H1 | SPACER, (Order Plate 892 481 C1 and VALVE STOP 892 479 C1)<br>U001064 and below<br>C001002 and up |
| 23 | 892 479 C1 | STOP, valve<br>U001065 and up<br>C001002 and up |
| 24 | 615 850 C1 | WASHER |

AXLE ASSEMBLY




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 884 101 C95 | AXLE ASSEMBLY (2) |
| | 26 650 R1 | BOLT (16) |
| | 206 468 H2 | WASHER (16) |
| | 25 985 R1 | NUT (16) |
| | | (Consists of the following parts - |
| 1 | 930 882 C1 | HOUSING, ASSEMBLY |
| 2 | 930 767 C1 | BOWL, axle (Axle S/N 1540 and up except 1543, 1544 & 1551 thru 1554 |
| 2 | | BOWL, axle (Axle S/N 1539 and below and 1543, 1544 & 1551 thru 1554 (Not Furnished Separately) |
| 3 | 9 410 359 | PLUG |
| 4 | 570 828 R1 | "O" RING |
| 5 | 190 302 H1 | PLUG |
| 6 | | PLANETARY HOUSING (See Axle Shaft and Hub in this Section)(2) |
| 7 | | DIFFERENTIAL (See Differential in this Section) (2) |
| 8 | | BRAKE (See Brake Group in this Section)(2) |
| 9 | 221 175 H1 | HOUSING, axle (Axle S/N 1540 and up, except, 1543, 1544 & 1551 thru 1554 (2) |
| 9 | | HOUSING, axle (Axle S/N 1539 and below and 1543, 1544 & 1551 thru 1554 (Not furnished separately) (2) |
| 10 | 91 916 R1 | BREATHER (Used w/BOWL, 930 767 C1) |
| 11 | 444 660 | PLUG (Used w/BOWL, 930 767 C1) |



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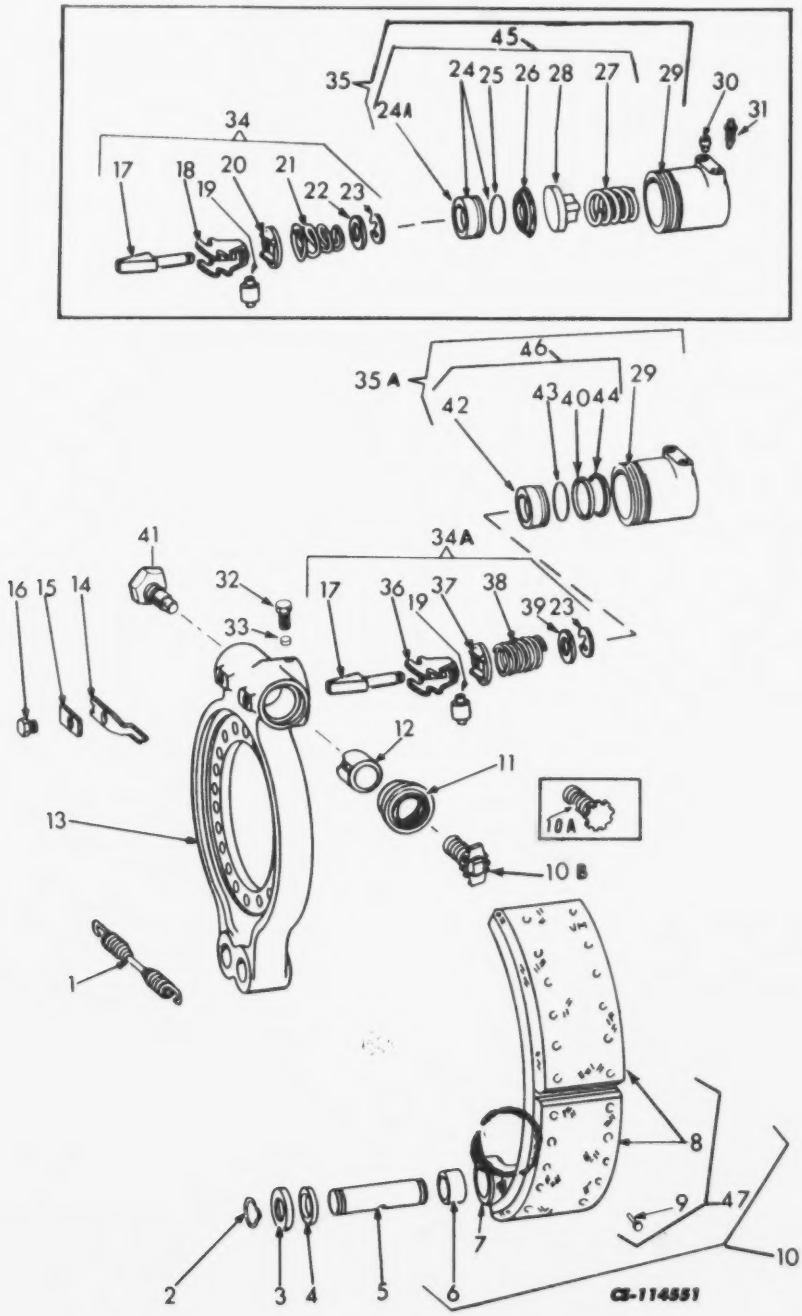
BRAKE GROUP
Axle S/N 1609 and below



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **BRAKE GROUP – Continued** | | |
| **Axle S/N 1609 and below** | | |
| 30 | 324 991 R1 | SEAT, tube (A) |
| 31 | 324 989 R1 | SCREW, bleeder (A) |
| 32 | 102 452 | SCREW, set (A) |
| 32 | | SCREW, set (Not furnished separately) (B, C, D, & E) |
| 33 | 324 990 R1 | PLUG (A) |
| 33 | | PLUG (Not furnished separately) (B, C, D & E) |
| 34 | 197 751 H1 | WEDGE ASSEMBLY (3-1/2" long) (A) |
| 34A | 931 169 C91 | WEDGE ASSEMBLY (5" long) (B, C, D & E) |
| 35 | 876 304 C91 | WHEEL CYLINDER ASSY (A) |
| 35A | 935 967 C93 | WHEEL CYLINDER ASSY (B, C, D & E) |
| 36 | 931 292 C1 | CAGE, roller retainer (B, C, D & E) |
| 37 | 931 294 C1 | WASHER (B, C, D & E) |
| 38 | 931 291 C1 | SPRING, wedge (B, C, D & E) |
| 39 | 931 293 C1 | WASHER (B, C, D & E) |
| 40 | | RING, back up (Order KIT, 944 534 C92) (B, C, D & E) |
| 41 | 324 946 R1 | PLUNGER, guide (B, C, D & E) |
| 42 | | PISTON (Order KIT, 944 534 C92) (B, C, D & E) |
| 43 | | "O" RING (Order KIT, 944 534 C92) (B, C, D & E) |
| 44 | | SEAL (Order KIT, 944 534 C92) (B, C, D & E) |
| 45 | 881 465 C91 | KIT, wheel cylinder (A) |
| 46 | 944 534 C92 | KIT, wheel cylinder (B, C, D & E) |
| 47 | 201 702 H1 | KIT, lining (A) (x) |
| 47 | 894 966 C91 | KIT, lining (Used with SHOE & LINING, 935 965 C91) (Order LINING KIT, 944 535 C92) (See Note 3) (B) (x) |
| 47 | 944 535 C92 | KIT, lining (C, D & E) (x) |

| REF. NO. | PART NUMBER | DESCRIPTION | |
|---|---|---|---|
| | 882 998 C91 | SPIDER ASSEMBLY (A) | |
| | | (Consists of - | |
| | | 2 BOLT | 196 882 H1 |
| | | 2 DETENT | 324 945 C1 |
| | | 2 GUIDE | 324 946 C1 |
| | | 2 LOCK | 347 155 R1 |
| | | 2 PLUNGER | 876 948 C1 |
| | | 2 SEAL | 615 132 C2 |
| | | § 1 SPIDER | ) |
| | 935 964 C92 | SPIDER ASSEMBLY (B, C, D & E) | |
| | | (Consists of - | |
| | | 2 BOLT | 944 403 C1 |
| | | 2 GUIDE | 324 946 R1 |
| | | 2 LOCK | 347 155 R1 |
| | | 2 PLUNGER | 944 272 C1 |
| | | 2 SEAL | 1 102 353 C1 |
| | | § 1 SPIDER | ) |

Note 3 - When replacing LININGS, 894 966 C91 order LINING KIT, 944 535 C91. Do not intermix old Linings with new Linings.

(x) - As Required.

§ - Not furnished separately.



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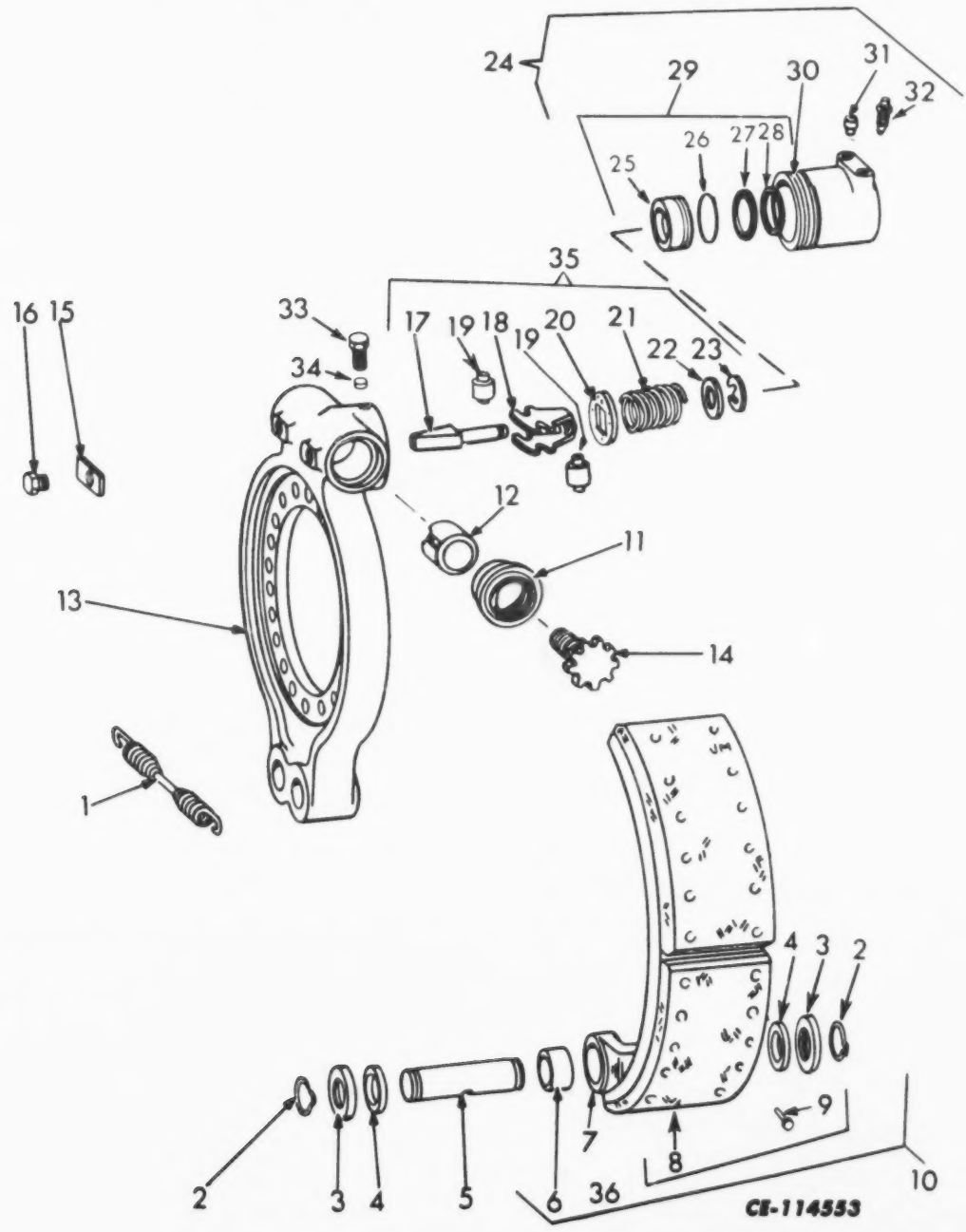
MEMORANDA

BRAKE GROUP
Axle S/N 1610 and up



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **BRAKE GROUP – Continued** | | |
| **Axle S/N 1610 and up** | | |
| A | 882 787 C93 | BRAKE ASSEMBLY (4)<br>Axle S/N 1610 thru 1960<br>(Order two BRAKE ASSEMBLIES, 882 787 C96) (See Note 1) |
| B | 882 787 C94 | BRAKE ASSEMBLY (4)<br>Axle S/N 1961 thru *<br>(Order two BRAKE ASSEMBLIES, 882 787 C96) (See Note 1) |
| C | 882 787 C95 | BRAKE ASSEMBLY (4)<br>Front Axle S/N * thru 2126<br>Rear Axle S/N * thru 2122<br>(Order two BRAKE ASSEMBLIES, 882 787 C96) (See Note 1) |
| D | 882 787 C96 | BRAKE ASSEMBLY (4)<br>Front Axle 02127 and up<br>Rear Axle 02123 and up |
| 1 | 930 468 C1 | SPRING, return (green)<br>(Order SPRING, 930 468 C2) (A) |
| 1 | 930 468 C2 | SPRING, return (yellow) (B, C & D) |
| 2 | 155 110 H1 | RETAINER, spring (4) |
| 3 | 56 122 R1 | RETAINER (4) |
| 4 | 155 108 H1 | FELT (4) |
| 5 | 155 107 H2 | PIN, anchor (2) |
| 6 | 95 373 R2 | BUSHING (4) |
| 7 | | SHOE, brake (Not furnished separately) (2) |
| 8 | | LINING (Not furnished separately) (4) |
| | 313 870 R1 | BOLT (C, D & E) (60) |
| | 26 030 R1 | KIT (C, D & E) (60) |
| | 120 380 | WASHER, lock (C, D) (60) |
| 9 | 83 829 R1 | RIVET (52) |
| 10 | 935 965 C91 | SHOE & LINING ASSEMBLY<br>(Order four SHOE & LINING ASSY, 937 707 C91) (Used with SPRING, 930 468 C1) (See Note 2) (A) (2) |
| 10 | 937 707 C91 | SHOE & LINING ASSEMBLY<br>(B, C & D) (2) |
| 11 | 615 132 C2 | SEAL (A) (2) |
| 11 | 1 102 353 C1 | SEAL (B, C & D) (2) |
| 12 | 876 948 C1 | PLUNGER (A) (2)<br>(Order the following parts -<br>1 BOLT 944 043 C1<br>1 PLUNGER 944 272 C1<br>1 SEAL 1 102 353 C1) |
| 12 | 944 272 C1 | PLUNGER (B, C & D) (2) |
| 13 | | SPIDER, brake (Not furnished separately) |
| | 27 514 R1 | BOLT, 2-1/2" long (24) |
| | 24 888 R1 | BOLT, 2" long (6) |
| | 25 529 R1 | NUT (24) |
| | 25 538 R1 | WASHER (30) |
| 14 | 630 225 C1 | BOLT, adjusting (1" diameter thread) (A) (2)<br>(Order the following parts -<br>1 BOLT 944 043 C1<br>1 PLUNGER 944 272 C1<br>1 SEAL 1 102 353 C1) |
| 14 | 944 043 C1 | BOLT, adjusting (1-1/8" diameter thread (B, C & D) (2) |
| 15 | 347 155 R1 | LOCK (2) |
| 16 | 324 946 R1 | GUIDE (2) |
| 17 | | WEDGE (Not furnished separately) |
| 18 | 931 292 C1 | CAGE, roller retainer |
| 19 | 196 892 H1 | ROLLER (2) |
| 20 | 931 294 C1 | WASHER |
| 21 | 931 291 C1 | SPRING, wedge |
| 22 | 931 293 C1 | WASHER |
| 23 | 373 523 R1 | WASHER, "E" |
| 24 | 935 974 C93 | WHEEL CYLINDER ASSEMBLY |
| 25 | | PISTON (Order KIT, 944 695 C92) |
| 26 | | "O" RING (Order KIT, 944 695 C92) |
| 27 | | RING, back up (Order KIT, 944 695 C92) |
| 28 | | SEAL (Order KIT, 944 695 C92) |
| 29 | 944 695 C92 | KIT, wheel cylinder |
| 30 | | HOUSING (Not furnished separately) |
| 31 | | SEAT, tube (Not furnished separately) |
| 32 | | SCREW, bleeder (Not furnished separately) |
| 33 | 102 452 | SCREW, set |
| 34 | 324 990 R1 | PLUG |

* - Serial number not available.

Note 1 - Replace both BRAKE ASSEMBLIES on one axle.

Note 2 - When replacing SHOE & LININGS, 935 965 C91 order four SHOE & LININGS, 937 707 C91. Do not intermix old Shoe & Linings with new Shoe & Linings on the same axle.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BRAKE GROUP – Continued** |
| | | **Axle S/N 1610 and up** |
| 35 | 931 169 C91 | WEDGE ASSEMBLY |
| 36 | 894 966 C91 | KIT, lining (Used with SHOE & LINING, 935 965 C91) (Order LINING KIT, 944 535 C92) (See Note 3) (A) (x) |
| 36 | 944 535 C92 | KIT, lining (B, C & D) (x) |
| | 935 964 C92 | SPIDER ASSEMBLY (Consists of · |
| | | 2 BOLT 944 403 C1 |
| | | 2 GUIDE 324 946 R1 |
| | | 2 LOCK 347 155 R1 |
| | | 2 PLUNGER 944 272 C1 |
| | | 2 SEAL 1 102 353 C1 |
| | | ▮ 1 SPIDER ) |

Note 3 - When replacing LININGS, 894 966 C91 order LINING KIT, 944 535 C91. Do not intermix old Linings with new Linings.
(x) - As Required.
▮ - Not furnished separately.


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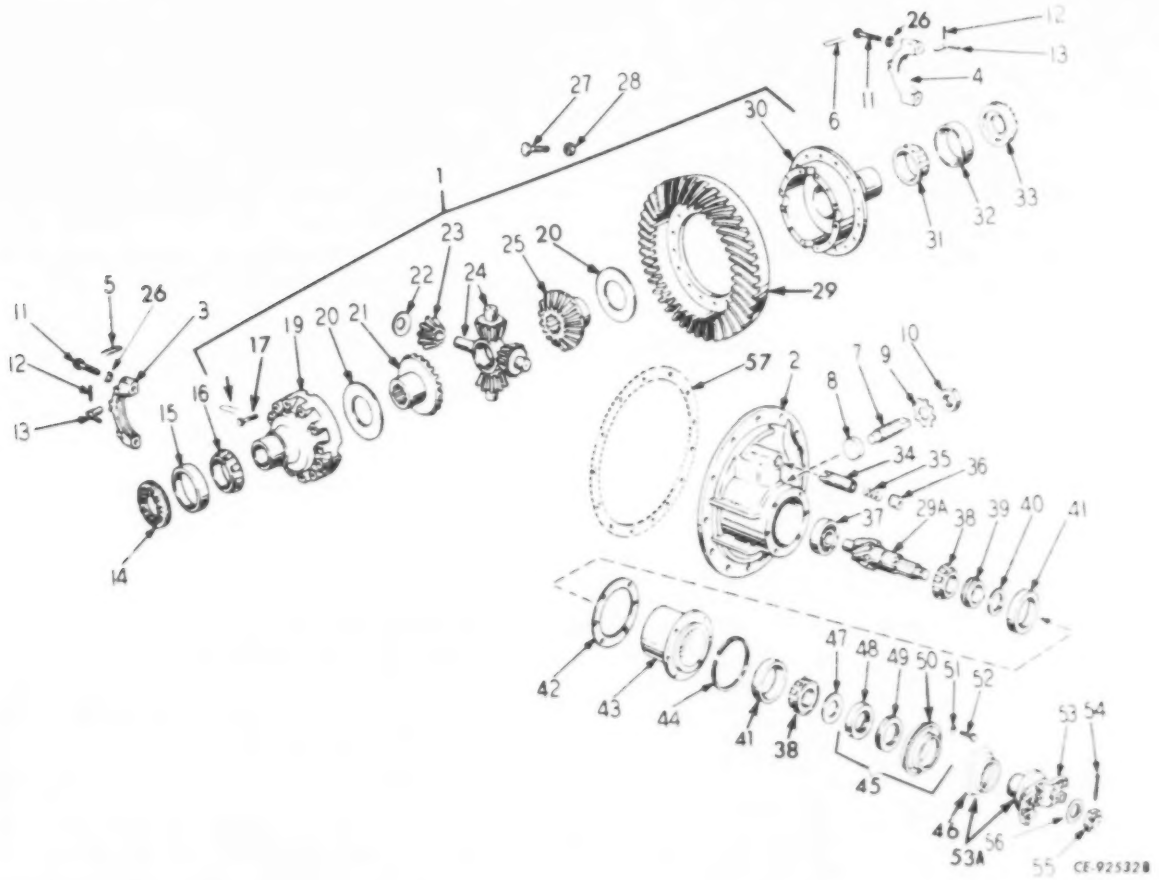
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

DIFFERENTIAL




| | | |
|---|---|---|
| | 931 860 C93 | DIFFERENTIAL ASSEMBLY (2) |
| | 27 578 R1 | BOLT, 12 point 2" long (8) |
| | 27 423 R1 | BOLT, 12 point 2-1/2" long (4) |
| | 25 547 R1 | WASHER, hardened (12) |
| | | (Consists of the following parts |
| 1 | 941 684 C91 | DIFFERENTIAL GEAR and CASE ASSEMBLY<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 1 | 878 361 C91 | DIFFERENTIAL GEAR and CASE ASSEMBLY<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 2 | | CARRIER, differential (Order ASSEMBLY, 941 686 C91)<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 2 | | CARRIER, differential (Order ASSEMBLY, 641 686 C91)<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 3 | | CAP, R.H. (Plain side) (#)<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up<br>and also 1582 thru 1585 |
| 3 | | CAP, R.H. (Plain side) (Order DIFFERENTIAL CARRIER & BEARING ASSEMBLY, 641 686 C91)<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |

(#) Order DIFFERENTIAL CARRIER & BEARING CAP ASSY, 941 686 C91

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| DIFFERENTIAL - Continued | | |
| 4 | | CAP, L.H. (Flanged side) (#)<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 5 | | WIRE, locking (16 ga. x 18" long) (Cut from bulk WIRE, 278 027 R1) |
| 6 | | WIRE, locking (16 ga. x 18" long) (Cut from bulk WIRE, 278 027 R1) |
| 7 | 144 516 R1 | SCREW, adjusting<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 8 | 48 754 H | BLOCK, thrust<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 9 | 177 933 H1 | LOCK, nut<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 10 | 50 607 R1 | NUT, check<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 11 | 78 708 R1 | SCREW, cap (4) |
| 12 | 103 419 | PIN, cotter (2) |
| 13 | 65 045 | LOCK, adjuster (2) |
| 14 | 92 589 H | BEARING, adjusting R.H.<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 14 | 177 998 H1 | BEARING, adjusting R.H.<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 15 | ST 982 | CUP, R.H.<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 15 | 155 721 H1 | CUP, R.H.<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 16 | 58 233 R91 | CONE, R.H.<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 16 | 157 065 H1 | CONE, R.H.<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 17 | | WIRE, locking (19 ga. x 24" long) (Cut from bulk WIRE, 3 108 749 R1) |
| 18 | 941 508 C1 | SCREW, cap (12) |
| 19 | 178 003 H1 | CASE, plain half |
| 20 | 79 017 H1 | WASHER, trust (2) |
| 21 | 877 661 C1 | GEAR, side R.H. |
| 22 | 79 019 H | WASHER, trust (4) |
| 23 | 877 662 C1 | PINION, side (4) |
| 24 | 464 656 C1 | SPIDER |
| 25 | 877 661 C1 | GEAR, side L.H. |
| 26 | 78 709 R1 | WASHER |
| 27 | 178 009 H2 | BOLT (16) |
| 28 | 202 318 H3 | NUT (16) |
| 29 | | PINION GEAR, (Not part of ASSEMBLY, 941 684 C91 & 878 361 C91) (Order GEAR and PINION SET, 226 895 R91) (Not part of ASSEMBLY 941 684 C91 & 878 361 C91) |
| 29A | | PINION (Order GEAR and PINION SET, 226 895 R91) |
| 30 | 178 013 H1 | CASE, flanged half |
| 31 | 55 447 R91 | CONE, L.H. |
| 32 | 55 446 R1 | CUP, L.H. |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **DIFFERENTIAL - Continued** | | |
| 33 | 144 549 R1 | BEARING, adjusting L.H.<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up,<br>and also 1582 thru 1585 |
| 33 | 178 016 H1 | BEARING, adjusting L.H.<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 34 | 884 587 C1 | DISTRIBUTOR, oil<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 35 | 68 681 H | SPRING<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below<br>except 1582 thru 1585 |
| 36 | 113 187 | PLUG, pipe<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 37 | 58 078 R91 | BEARING, inner<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up<br>and also 1582 thru 1585 |
| 37 | 178 021 H1 | BEARING, inner<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 38 | 310 968 C91 | CONE<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up,<br>and also 1582 thru 1585 |
| 38 | 202 323 H1 | CONE<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 39 | 68 974 R1 | SPACER<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up,<br>except 1582 thru 1585 |
| 39 | 58 088 R1 | SPACER<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below<br>except 1582 thru 1585 |
| 40 | 421 914 C1 thru 421 949 C1 | WASHER, pinion bearing spacer .167 thru .202<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up,<br>and also 1582 thru 1585 |
| 40 | 62 852 R1 thru 62 867 R1 | WASHER, pinion bearing spacer .167 thru .197<br>.002 Variation Between Washers |
| 40 | 306 615 C1 | WASHER, pinion bearing spacer .199 |
| 40 | 306 616 C1 | WASHER, pinion bearing spacer .201<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 41 | 65 071 H | CUP (2)<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up<br>and also 1582 thru 1585 |
| 41 | 68 875 R1 | CUP (2)<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 42 | 367 036 C1 | SHIM, cage .003 (x) |
| 42 | 367 037 C1 | SHIM, cage .005 (x) |
| 42 | 367 037 C1 | SHIM, cage .005 (x) |
| 42 | 367 038 C1 | SHIM, cage .010 (x) |
| 42 | 367 039 C1 | SHIM, cage .020 (x) |
| 42 | 367 040 C1 | SHIM, cage .030 (x) |
| | | )Front Axle S/N 1586 and up )Rear Axle S/N 1588 and up, & also 1582 thru 1585 |
| 42 | 58 085 R2 | SHIM, cage .003(x) |
| 42 | 202 326 H1 | SHIM, cage .005(x) |
| 42 | 58 086 R2 | SHIM, cage .010(x) |
| 42 | 202 327 H1 | SHIM, cage .020(x) |
| 42 | 58 087 R2 | SHIM, cage .030(x) |
| | | )Front Axle S/N 1585 and below, )Rear Axle S/N 1587 and below, )except 1582 thru 1585 |
| 43 | 941 687 C91 | CAGE, w/two CUP, 65071H<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up,<br>and also 1582 thru 1585 |
| 43 | 206 155 H1 | CAGE w/two CUP, 68875R1<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 44 | 178 032 H1 | SEAL, cork<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below,<br>except 1582 thru 1585 |
| 45 | 359 106 C91 | PINION SHAFT OIL SEAL and RETAINER ASSEMBLY<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up,<br>except 1582 thru 1585 |

(x) - As Required.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| DIFFERENTIAL - Continued | | |
| 45 | 144 530 R91 | PINION SHAFT, OIL SEAL and RETAINER ASSEMBLY<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, and also 1582 thru 1585 |
| 46 | 77 197 R1 | MUDSLINGER<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, except 1582 thru 1585 |
| 47 | 941 688 C1 | WASHER, flat<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up<br>except 1582 thru 1585 |
| 47 | 86 113 R1 | WASHER, flat<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 48 | 291 222 C91 | SEAL, oil |
| 49 | 878 362 C1 | SEAL, felt<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 50 | | RETAINER, seal (Not furnished separately) (Order PINION SHAFT OIL SEAL and RETAINER ASSEMBLY, 359 106 C91)<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 50 | 178 073 H1 | RETAINER, seal<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 51 | 103 325 | WASHER, lock (6) |
| 52 | 271 585 | BOLT (6) |
| 53 | 194 646 H2 | YOKE<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 53A | 941 685 C91 | END YOKE & MUDSLINGER ASSEMBLY<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1582 and up<br>except 1586 and 1587 |
| 54 | 941 689 C1 | PIN, cotter<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585 |
| 54 | 103 391 | PIN, cotter<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| 55 | 104 732 R1 | NUT, pinion end |
| 56 | 967 960 R1 | WASHER |
| 57 | | GASKET (Order PLASTIC GASKET, 207 041 H1) |
| | 70 516 H | BOLT, cap-oil distributor locating<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| | 103 328 | WASHER, lock |
| | 78 707 R1 | BUSHING, dowel (Used w/Right and Left Hand Caps) (4) |
| | 941 686 C91 | DIFFERENTIAL CARRIER & BEARING ASSEMBLY<br>Front Axle S/N 1586 and up<br>Rear Axle S/N 1588 and up, and also 1582 thru 1585<br>(Consists of -<br>2 BUSHING 78 707 R1<br>1 CAP, L.H. 941 693 C1<br>1 CAP, R.H. 941 694 C1<br>§ 1 CARRIER<br>1 SCREW, cap 78 708 R1<br>1 WASHER 78 709 R1) |
| | 215 191 H1 | DIFFERENTIAL CARRIER & BEARING ASSEMBLY<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1585 and below, except 1582 thru 1585<br>(Order DIFFERENTIAL, 941 686 C91)<br>(Consists of -<br>1 BLOCK 48 754 H<br>4 BUSHING 78 707 R1<br>§ 1 CAP, L.H.<br>§ 1 CAP, R.H.<br>§ 1 CARRIER<br>1 LOCK, nut 177 993 H1<br>1 NUT, check 50 607 R1<br>1 SCREW, adjusting 144 516 R1<br>1 SCREW, cap 78 708 R1) |
| | 226 895 R91 | GEAR & PINION SET<br>(Includes items 29 and 29A) |
| | 202 324 H1 | SLEEVE, pinion bearing inner<br>Front Axle S/N 1585 and below<br>Rear Axle S/N 1587 and below, except 1582 thru 1585 |
| | 179 816 | BOLT (2) |
| | 202 325 H1 | LOCK (2) |
| | 278 027 R1 | WIRE,bulk locking (16ga.)50ft. (x) |
| 3 | 108 749 R1 | WIRE, bulk locking(19ga.) 50ft. (x) |

(x) - As Required
(§) - Not Furnished Separately.



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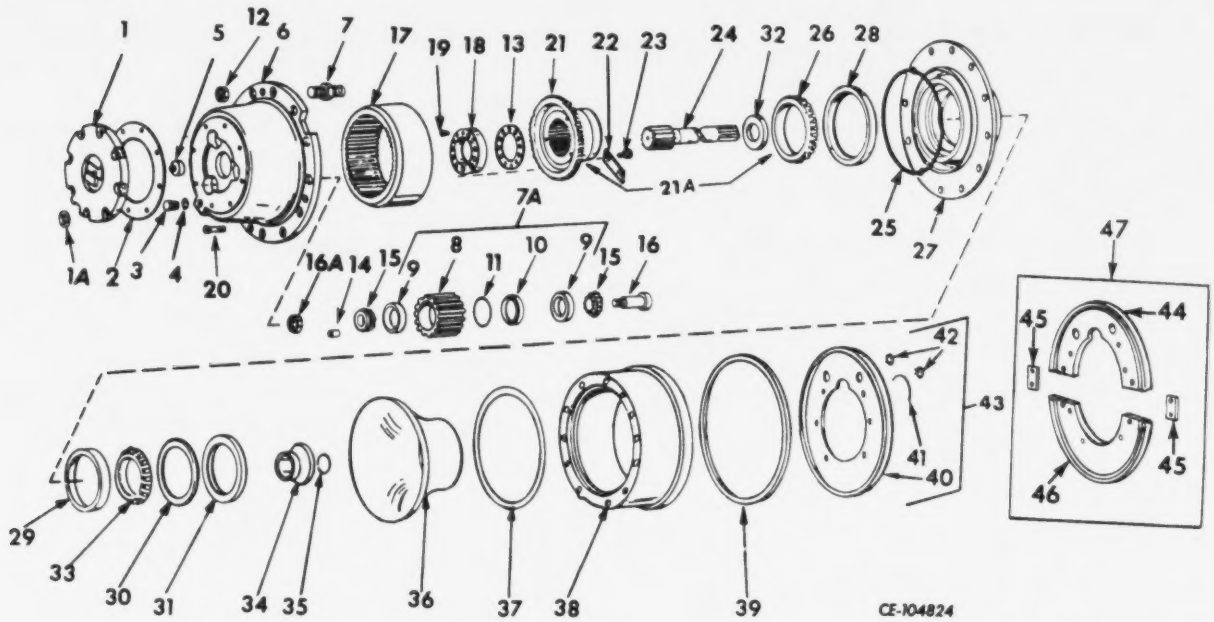
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

SHAFT & HUB (FRONT & REAR)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 929 477 C1 | COVER, planet carrier (4)<br>Axle S/N 1540 and up, except, 1543, 1544 & 1551 thru 1554 |
| | 24 840 R1 | BOLT (16) |
| 1 | 885 629 C2 | COVER, planet carrier (4)<br>Axle S/N * and below, and also 1539, 1543, 1544 & 1551 thru 1554 |
| | 24 840 R1 | BOLT (will work BOLT, 179 839) (16) |
| 1 | 219 610 H1 | COVER, planet carrier w/two BUTTON, 174 050 H3 (Order PLANET CARRIER COVER, 885 629 C2) (4)<br>Axle S/N * and below, and also 1539, 1543, 1544 & 1551 thru 1554 |
| 1A | 125 003 H1 | WASHER, sealing (Order BOLT, 887 405 C1) (32) |
| 2 | 174 049 H1 | GASKET (4) |
| 3 | 190 302 H1 | PLUG (4) |
| 4 | 570 828 R1 | "O" RING (4) |
| 5 | 174 050 H3 | BUTTON, thrust (Used w/Cover 219 610 H1) (8) |
| 6 | 217 150 H1 | CARRIER, planet (4) |
| 7 | 217 146 H2 | STUD (84) |
| 7A | 176 240 H1 | PLANET GEAR & CUP ASSEMBLY (12) |
| 8 | 174 053 H1 | PINION, planet (12) |
| 9 | ST-951 | CUP, roller bearing (24) |
| 10 | 175 808 H1 | SPACER (12) |
| 11 | 175 809 H1 | RING, retaining (12) |
| 12 | 217 164 H1 | NUT (84) |
| 13 | 197 781 H2 | SHIM (.005) (AR) |
| 13 | 197 782 H2 | SHIM (.010) (AR) |
| 14 | 19 841 R1 | PIN, dowel (12) |
| 15 | 175 810 H1 | CONE, roller bearing (24) |
| 16 | 214 883 H1 | SHAFT, planet pinion (12) |
| 16A | 214 882 H1 | NUT (12) |
| 17 | 174 059 H3 | GEAR, ring (4)<br>U001283 and below except 01279 and 01281<br>C001287 and below<br>(Order the following parts -<br>1 RING GEAR 923 968 C1<br>4 LOCK PLATE 923 822 C1) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | SHAFT & HUB (FRONT & REAR) - Continued |
| 17 | 923 968 C1 | GEAR, ring (4)<br>U001284 and up also 01279, and 01281<br>C001288 and up |
| 18 | 209 324 H1 | RETAINER (4) |
| 19 | 209 325 H1 | BOLT (48) |
| 20 | 876 726 C1 | BOLT (12) |
| 21 | 174 061 H1 | HUB, ring gear (4) |
| 21A | 176 239 H1 | HUB & BEARING CONE ASSEMBLY (4) |
| 22 | 174 062 H1 | LOCK, plate (Used with RING GEAR, 174 059 H3) (16) |
| 22 | 923 822 C1 | LOCK, plate (Used with RING GEAR, 923 968 C1) (16) |
| 23 | 187 053 H1 | BOLT (12) |
| 24 | 194 588 H2 | SHAFT,axle (4) |
| 25 | 174 076 H1 | RING (4) |
| 26 | 614 921 C91 | CONE, roller bearing (4) |
| 27 | 888 202 C1 | HUB (4) |
| 28 | 614 922 C1 | CUP (4) |
| 29 | 62 874 R1 | CUP (4) |
| 30 | 174 098 H1 | SPACER (4) |
| 31 | 174 099 H1 | SEAL (4) |
| 32 | 194 583 H1 | SEAL, oil (4)<br>Axle S/N 1539 and below, and also 1543, 1544 & 1551 thru 1554 |
| 33 | 62 873 R91 | CONE, roller bearing (4) |
| 34 | 221 148 H1 | RETAINER, ring (4) |
| 35 | 285 253 R1 | "O" RING (4) |
| 36 | 174 077 H4 | SCAVENGER (4) |
| 37 | 176 215 H1 | RING (4) |
| 38 | 217 149 H3 | DRUM, brake (4) |
| 39 | 174 081 H1 | SEAL, brake drum (For Units so equipped) (4) |
| 40 | 194 612 H1 | SHIELD (For units so equipped (4) |
| | 179 837 | 3/8NC x 3/4" BOLT (24) |
| | 103 321 | 3/8" lock WASHER (24) |
| 41 | 194 611 H1 | SEAL, cylinder (For units so equipped) (4) |
| 42 | 432 607 | BUTTON, plug (8)<br>Axle S/N 1539 and below, and also 1543, 1544 & 1551 thru 1554 |
| 43 | 194 610 H1 | SHIELD ASSEMBLY (For units so equipped) (4) |
| 44 | | SHIELD, upper half (Not furnished separately) (4) |
| | 24 839 R1 | BOLT, 3/8NC x 3/4" (4) |
| | 120 382 | WASHER, 3/8" lock (4) |
| 45 | | BAR, (Not furnished separately) (4) |
| | 25 480 R1 | BOLT, 1/4NC x 5/8" (16) |
| | 26 110 R1 | NUT, 1/4 (16) |
| 46 | | SHIELD, lower (Not furnished separately) (4) |
| | 24 839 R1 | BOLT, 3/8NC x 3/4" (12) |
| | 120 382 | WASHER, 3/8" lock (12) |
| 47 | 931 623 C91 | KIT, dust shield (4) |
| | 217 148 H1 | CARRIER GEAR PLANET ASSEMBLY (4)<br>(Composed of -<br>1 CARRIER 217 150 H1<br>6 CONE 175 810 H1<br>3 GEAR & CUP 176 240 H1<br>3 NUT 214 882 H1<br>3 PIN 19 841 R1<br>3 SHAFT 214 883 H1 |



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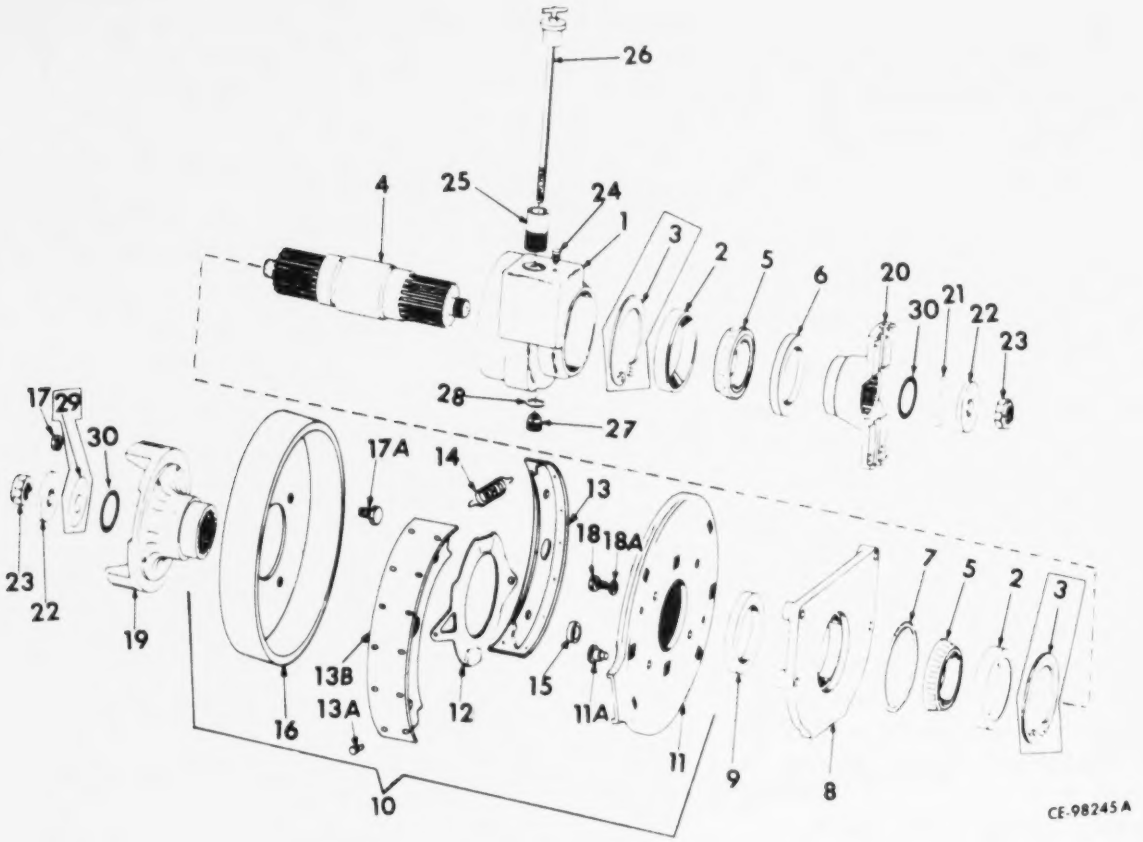
TRANSFER DRIVE




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 194 411 H5 | TRANSFER DRIVE ASSEMBLY |
| | 24 864 R1 | SCREW, 2" hex-hd cap (4) |
| | 24 865 R1 | SCREW, 2-1/2" hex-hd cap (2) |
| | 25 546 R1 | WASHER, lock (6) |
| | | (Consists of the following parts except 29 - |
| 1 | 194 413 H2 | HOUSING |
| 2 | 195 785 H1 | CUP, bearing (2) |
| 3 | 195 787 H1 | RING, retaining (2) U001194 and below |
| | | C001002 and up |
| 4 | 194 417 H1 | SHAFT U001194 and below C001002 and up |
| | | (Order the following parts - 1 SHAFT 896 764 C2 1 SHIM 896 914 C1 1 SHIM 896 915 C1 1 SHIM 896 916 C1) |
| 4 | 896 764 C2 | SHAFT U001195 and up |
| 5 | 195 784 H1 | CONE, bearing (2) |
| 6 | 195 786 H1 | SEAL |
| 7 | 3 046 999 R1 | "O" RING |
| 8 | 194 422 H1 | COVER |
| | 179 481 | 3/8NC x 1-1/4" CAP SCREW (8) |
| | 103 321 | 3/8" lock WASHER (8) |
| 9 | 338 549 R91 | SEAL, oil |
| 10 | 194 424 H1 | BRAKE, parking |
| 11 | 194 276 H1 | PLATE ASSEMBLY w/RIVET 139 343 H1 |
| 11A | 139 343 H1 | RIVET |
| 12 | 141 127 H1 | LEVER |
| 13 | 141 131 H1 | SHOE & LINING ASSEMBLY w/RIVET 162 557 H1 qty (28) and LINING 141 128 H1 qty (2) |

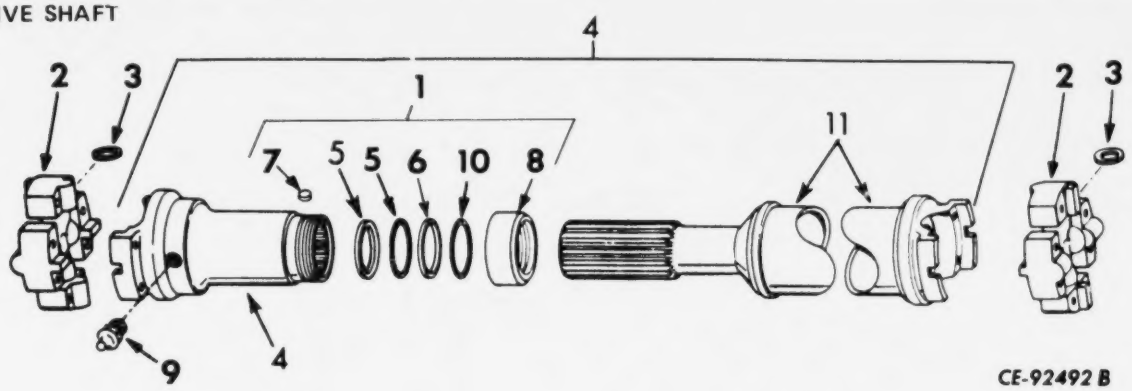
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TRANSFER DRIVE - Continued** |
| 13A | 162 557 H1 | RIVET (28) |
| 13B | 141 128 H1 | LINING (2) |
| 14 | 136 376 R1 | SPRING (2) |
| 15 | 138 109 R1 | ROLLER |
| 16 | 198 788 H1 | DRUM |
| 17 | 18 526 R1 | NUT, 7/16" - 14NC Esna (4) |
| 17A | 179 860 | SCREW, 7/16NC x 1-1/4" cap (4) |
| 18 | 179 859 | SCREW, 7/16NC x 1-1/8" cap (4) |
| 18A | 103 321 | WASHER, 7/16" lock (4) |
| 19 | 194 425 H2 | YOKE |
| 20 | 194 426 H3 | YOKE |
| 21 | 194 294 H1 | SEAL (2)<br>U001194 and below<br>C001002 and up |
| 21 | 896 914 C1 | SHIM, .005 (X)<br>U001195 and up |
| 21 | 896 915 C1 | SHIM .007 (X)<br>U001195 and up |
| 21 | 896 916 C1 | SHIM .020 (X)<br>U001195 and up |
| 22 | 194 293 H1 | RETAINER (2) |
| 23 | 123 298 H1 | NUT, self locking (2) |
| 24 | 152 127 H1 | BREATHER |
| 25 | 194 427 H1 | NIPPLE |
| 26 | 214 505 H1 | DIPSTICK |
| 27 | 113 933 H | PLUG, magnetic |
| 28 | 114 485 H1 | WASHER, copper |
| 29 | 194 294 H1 | SEAL<br>U001194 and below<br>C001002 and up |
| 30 | 927 970 C1 | SEAL (See Note) (2) |
| | 634 018 C1 | ADHESIVE, loctite 601 |

(X) - As Required.

Note: Part of Transfer Drive, 194 411 H3. Also used on shaft with shouldered ends when used with yoke having corresponding shoulder.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

DRIVE SHAFT




CE-92492 B

Parts without letters after the description indicates the part is used for all Drive Shafts: Letters below A, B, C and D are used to identify separate Drive Shafts.

| | | |
|---|---|---|
| A | 888 533 C91 | DRIVE SHAFT (955 92 36044) Transmission to Transfer Drive |
| B | 888 531 C91 | DRIVE SHAFT (955 92 36042) Transmission to Rear Axle |
| C | 888 529 C91 | DRIVE SHAFT (955 92 36043) Transmission to Front Axle |
| D | 888 535 C91 | DRIVE SHAFT (955 92 36045) Converter to Transmission |
| | 890 671 C91 | KIT, dust cap repair (Drive Shaft A, B and C) |
| 1 | 198 510 H1 | KIT, dust cap repair (Drive Shaft D) Cork Washers 128 533 H1 and two Grease Fitting 109 461 (Drive Shafts A, B and C) (2) |
| 2 | 135 766 H1 | SPIDER AND BEARING w/four |
| 2 | 135 765 H1 | SPIDER AND BEARING w/four Seals 198 506 H2 and two Grease Fitting 109 461 (Drive Shaft D) (2) |
| | 21 121 R1 | NUT, 1/2 - 20NF Esna (8) — Drive Shafts A, B and C |
| | 21 205 R1 | BOLT, 1/2 x 2-1/2" Gr. (Used w/Nut (8)) — Drive Shafts A, B and C |
| | 181 435 | BOLT, (Used w/threaded Yoke (8)) — Drive Shafts A, B and C |
| | 197 605 H1 | BOLT, (Used w/Nut) (8) — Drive Shafts A, B and C |
| | 114 494 | NUT, 3/8" - 24 jam (8) — Drive Shaft D |
| | 25 705 R1 | BOLT, (Used w/threaded Yoke (8)) — Drive Shaft D |
| 3 | 128 533 H1 | WASHER, cork (Drive Shafts A,B and C) (8) |
| 3 | 198 506 H2 | WASHER, cork (Drive Shaft D) |
| 4 | | SLIP & WELD YOKE ASSEMBLY (Order Drive Shaft, 888 533 C91) (Drive Shaft A) |
| 4 | | SLIP & WELD YOKE ASSEMBLY (Order Drive Shaft, 888 531 C91) (Drive Shaft B) |
| 4 | | SLIP & WELD YOKE ASSEMBLY (Order Drive Shaft, 888 529 C91) (Drive Shaft C) |
| 4 | | SLIP & WELD YOKE ASSEMBLY (Order Drive Shaft, 888 535 C91) (Drive Shaft D) |
| 5 | 180 223 H1 | WASHER, felt retainer (Drive Shaft A, B and C) |
| 5 | 198 512 H1 | WASHER, metal (Drive Shaft D) |
| 6 | 302 673 C1 | WASHER, felt (Drive Shaft A, B and C) |
| 6 | 198 511 H1 | WASHER, felt (Drive Shaft D) |
| 7 | 175 046 H1 | LOCK, nylon |
| 8 | 175 027 H1 | CAP, dust (Drive Shaft A, B and C) |
| 8 | 890 675 C1 | CAP, dust (Drive Shaft D) |
| 9 | 109 461 | FITTING |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| DRIVE SHAFT - Continued | | |
| 10 | 180 223 H1 | WASHER, felt (Drive Shaft A, B and C) |
| 10 | 198 512 H1 | WASHER, felt (Drive Shaft D) |
| | 25 705 R1 | BOLT (8) |
| | 25 279 R1 | BOLT (16) |
| | 109 461 | FITTING, grease (3) |
| | 25 279 R1 | BOLT, Trans. output yokes (8) |



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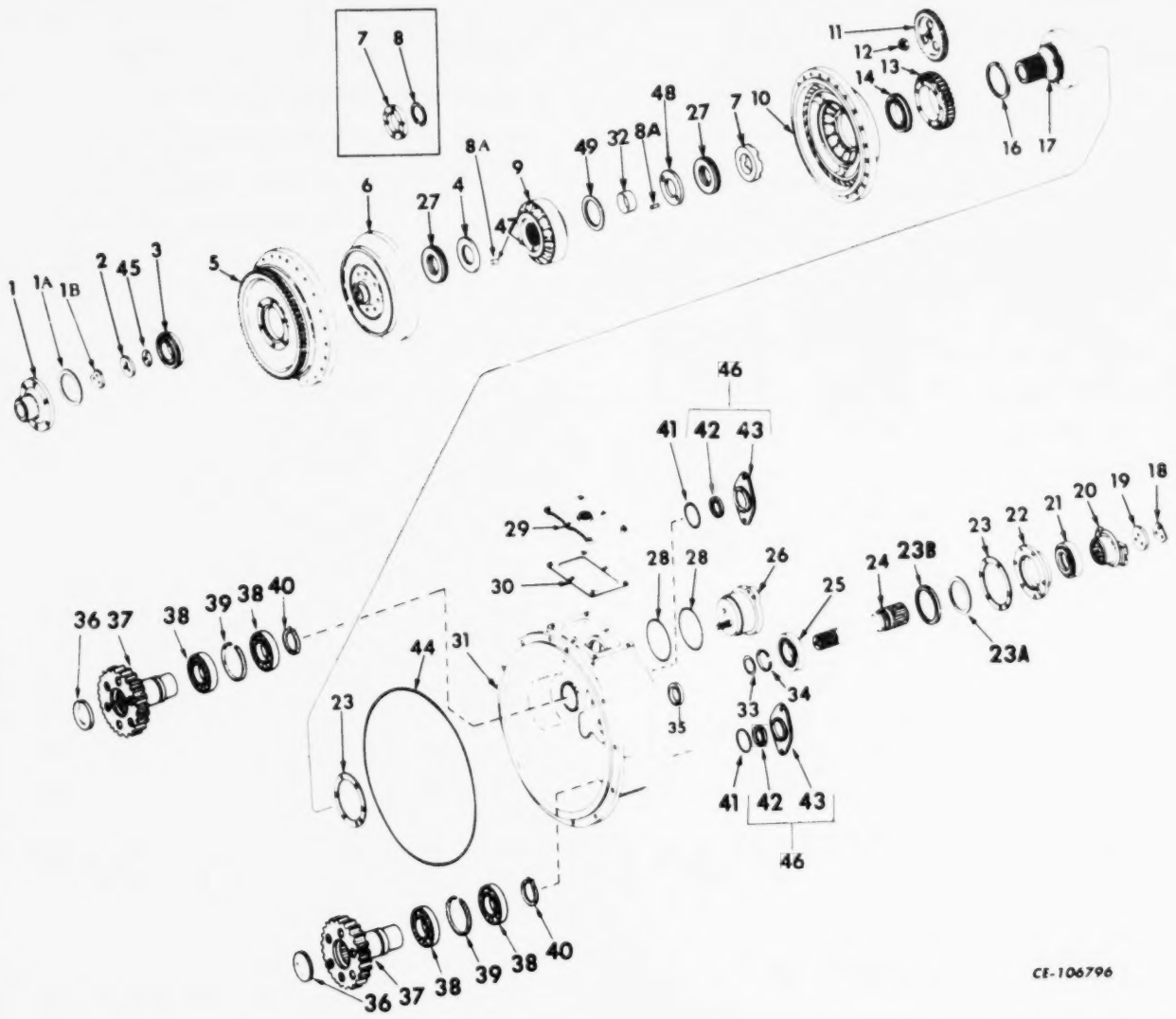
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

TORQUE CONVERTER




Parts without letters after the description indicates the part is used for all Torque Converters. Letters "A" thru "D" are used to identify separate Torque Converters.

A 884 026 C92 TORQUE CONVERTER ASSEMBLY
(D-313 025 00-9)
*and below
(Order the following parts -

| | | |
|---|---|---|
| 1 | ADAPTER | 380 633 R1 |
| 1 | ADAPTER | 9 410 209 |
| 4 | BOLT | 179 890 |
| 4 | BOLT | 894 921 C1 |
| 2 | BUSHING | 21 114 R1 |
| 1 | CHECK VALVE | 896 556 C1 |

(Order the following parts - Continued

| | | |
|---|---|---|
| 2 | CLAMP | 215 014 H1 |
| 1 | CONVERTER | 921 321 C93 |
| 1 | ELBOW | 892 495 C1 |
| 1 | FILTER STRAINER | 921 574 C1 |
| 1 | FLANGE ADAPTER | 894 904 C1 |
| 1 | GASKET | 169 206 H1 |
| 1 | HOSE | 924 203 C1 |
| 1 | "O" RING | 296 247 R1 |
| 1 | "O" RING | 301 016 R1 |
| 1 | "O" RING | 876 077 C1 |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| TORQUE CONVERTER - Continued | | |
| B | 892 460 C91 | TORQUE CONVERTER ASSEMBLY (D-313 240 00-4) U00* thru 01179 C00* thru 01228 (Order the following parts - |
| | 1 | ADAPTER 380 633 R1 |
| | 1 | ADAPTER 9 410 209 |
| | 4 | BOLT 179 890 |
| | 4 | BOLT 894 921 C1 |
| | 1 | CHECK VALVE 896 556 C1 |
| | 2 | CLAMP 215 014 H1 |
| | 1 | CONVERTER 921 321 C93 |
| | 1 | FILTER STRAINER 921 574 C1 |
| | 1 | FLANGE ADAPTER 894 904 C1 |
| | 1 | GASKET 169 206 H1 |
| | 1 | HOSE 924 203 C1 |
| | 1 | "O" RING 296 247 R1 |
| | 1 | "O" RING 301 016 R1 |
| | 1 | "O" RING 876 077 C1) |
| C | 921 321 C91 | TORQUE CONVERTER ASSEMBLY (Order Torque Converter, 921 321 C93) U001180 thru 01398 C001229 thru 01384 |
| D | 921 321 C92 | TORQUE CONVERTER ASSEMBLY (Order Torque Converter, 921 321 C93) U001399 thru * C001385 thru 01808 |
| E | 921 321 C93 | TORQUE CONVERTER ASSEMBLY U00 * and up C001809 and up (Consists of items 1 thru 45 except 44) |
| | 70 427 R1 | BOLT (12) |
| | 103 322 | 7/16" lock WASHER (Order twelve BOLT, 921 112 C1) (12) |
| 1 | 627 870 C3 | COVER, housing |
| | 179 839 | SCREW, hex-hd cap (6) |
| | 103 321 | WASHER, lock (6) |
| 1A | 199 348 H3 | SHIM, annular (.005) (*) (X) |
| 1A | 199 351 H3 | SHIM, annular (.010) (*) (X) |
| 1A | 199 352 H3 | SHIM, annular (.020) (*) (X) |
| 1B | 610 256 C1 | PLATE, lock (*) |
| | 454 869 | BOLT (3) |
| 2 | 199 346 H3 | WASHER, retainer (Converter A, B & C) |
| 2 | 324 088 R1 | WASHER, retainer (Converter D & E) |
| 3 | ST-296 | BEARING, ball |
| 4 | 930 358 C1 | RING, thrust (Converter D & E) |
| 5 | 199 345 H2 | HOUSING, drive converter |
| 6 | 199 344 H3 | HUB, turbine converter (Converters A, B & C) |
| 6 | 930 354 C93 | HUB, turbine converter (Converter D & E) |
| 7 | 324 085 R2 | SPACER (Converter A, B & C) |
| 7 | 930 359 C1 | SPACER (Converter D & E) |
| 8 | 641 207 R1 | SNAP RING, internal |
| 8A | 17 132 R1 | PIN, spring (Converter A, B & C) |
| 8A | 19 961 R1 | PIN, spring (Converter D & E) (2) |
| 9 | | STATOR, converter (Not furnished separately) |
| 10 | 875 576 C2 | IMPELLER (Order IMPELLER, 934 861 C1 and seven (7) BOLT, 932 584 C1) Converters A, B & C) |
| 9 | 409 013 | BOLT (24) |
| 10 | 934 861 C1 | IMPELLER (Converter A,B, & C) |
| 9 | 409 013 | BOLT (24) |
| 10 | 930 373 C1 | IMPELLER (Order IMPELLER, 934 860 C1 and seven BOLT, 932 584 C1) (Converter D & E) |
| 9 | 409 013 | BOLT (24) |
| 10 | 934 860 C1 | IMPELLER (Converter D & E) |
| 9 | 409 013 | BOLT (24) |
| 11 | 199 331 H1 | GEAR (30T) |
| 12 | 19 263 R1 | NUT, 5/8" - 18NF Esna (*) |
| 13 | 875 574 C1 | GEAR |
| | 19 739 R1 | BOLT, lock (Used w/IMPELLER 875 576 C2 & 930 373 C1) (7) |
| | 932 584 C1 | BOLT, hex (Used w/IMPELLER, 934 861 C1 & 934 860 C1) (7) |
| | 363 196 R1 | WASHER, plain (7) |
| 14 | 606 608 C91 | BEARING, ball |
| 15 | 882 185 C91 | RETAINER BEARING ASSEMBLY |
| 16 | 156 252 H2 | SEAL RING (Converter A & B) |
| 16 | 210 858 H1 | SEAL RING (Converter C, D & E) (#) |
| 17 | 324 061 R1 | HUB, sleeve ground |
| 18 | 324 071 R2 | PLATE, locking (*) |
| | 454 869 | 7/16-18 x .75 BOLT (3) |
| 19 | 324 072 R2 | WASHER, retainer |
| 20 | 197 976 H1 | YOKE, joint |
| 21 | 333 996 R92 | SEAL, oil (*) |

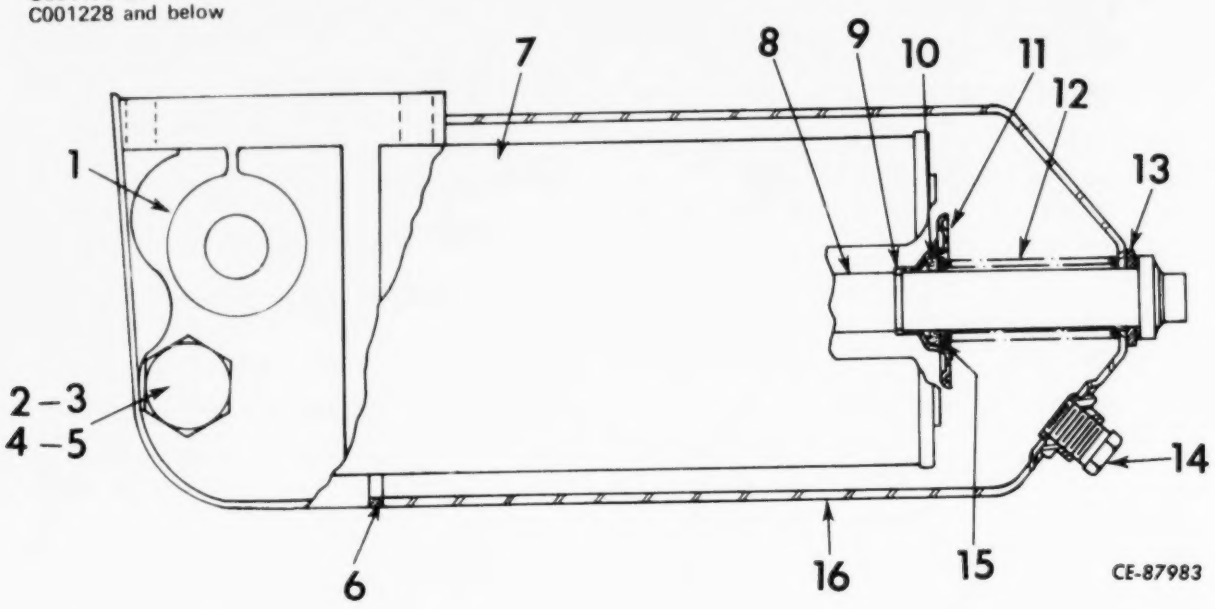
(*) - Also part of KIT 894 682 C91
(X) - As Required.
(*) - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **TORQUE CONVERTER - Continued** | | |
| 22 | 610 254 C1 | RETAINER, bearing |
| | 179 846 | 3/8" - 16 x 1.875 BOLT (6) |
| | 103 321 | 3/8" lock WASHER (6) |
| 23 | 324 069 R1 | GASKET, retainer bearing (#) (2) |
| 23A | 338 972 R1 | SHIM (.005) (#) (X) |
| 23A | 347 089 R1 | SHIM, annular (.010) (#) (X) |
| 23A | 347 090 R1 | SHIM, annular (.020) (#) (X) |
| 23A | 625 858 C1 | SHIM, annular (.050) (Converter A) (X) |
| 23B | 197 975 H1 | SPACER, plain |
| 24 | 889 614 C1 | SHAFT, output (Converter A, B & C) |
| 24 | 930 375 C2 | SHAFT, output (Converter D & E) |
| 25 | ST-717 | BEARING, ball |
| 26 | | PUMP, charging (See Charging Pump in this Section) |
| | 103 321 | 3/8" lock WASHER (2) |
| | 179 842 | 3/8NC x 1-3/8" BOLT (2) |
| 27 | 932 286 C91 | BEARING, thrust (Converter D & E) |
| 28 | 393 120 R1 | SEAL, "O" ring (#) (2) |
| 29 | 878 296 C1 | COVER, housing converter |
| | 179 841 | 3/8" x 1-1/4" BOLT (6) |
| | 103 321 | 3/8" lock WASHER (6) |
| 30 | 199 295 H1 | GASKET, cover (Converter A) |
| 30 | 1 101 592 C1 | GASKET, cover (Converter B, C, D & E) (#) |
| 31 | 199 328 H1 | HOUSING, converter (1" ports) (See NOTE) |
| 32 | 930 368 C1 | SPACER (Converter D & E) |
| 33 | 156 283 H1 | SEAL RING, piston hook type |
| 34 | 336 971 R1 | SNAP RING, external |
| 35 | 889 615 C1 | SPACER |
| 36 | 217 794 H1 | PLUG, expansion (2) |
| 37 | 882 193 C1 | GEAR (39T) (2) |
| 38 | ST-201 | BEARING, ball (4) |
| 39 | 197 971 H1 | SNAP RING, internal (2) |
| 40 | 199 399 H1 | SNAP RING, external (2) |
| 41 | 22 414 R1 | "O" RING (#) (2) |
| 42 | 199 294 H1 | SEAL, oil (#) |
| 43 | 199 334 H1 | ADAPTER (2) |
| 44 | 194 901 H1 | "O" RING (#) (Not furnished as part of Torque Converter Assembly) |
| 45 | 210 877 H1 | SHIM |
| | 194 899 H2 | RING, drive |
| | 24 841 R1 | SCREW, hex-hd cap (8) |
| | 120 382 | WASHER, lock (8) |
| 46 | 882 188 C91 | ADAPTER, drive (2) |
| 47 | 884 150 C91 | STATOR ASSEMBLY (Converter A, B, & C) |
| 47 | 930 360 C92 | STATOR ASSEMBLY (Converter D & E) |
| 48 | 930 369 C1 | RING, thrust (Converter D & E) |
| 49 | 930 370 C1 | SHIM, .020 (Converter D & E) |
| 49 | 930 371 C1 | SHIM, .005 (Converter D & E) |

NOTE: When Servicing HOUSING 199 328 H1 with 3/4" ports also order two REDUCER BUSHINGS 21 114 R1.

(#) - Also part of KIT 894 682 C91
(X) - As Required.

CONVERTER LINE OIL FILTER
U001179 and below
C001228 and below




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 922 026 C1 | OIL FILTER ASSEMBLY (Consists of the following parts- |
| 1 | 191 479 H1 | BASE ASSEMBLY, oil filter (Composed of 1 GASKET 191 477 H1; 1 PLUG 191 474 H1; 1 SPRING 191 475 H1; 1 VALVE 191 476 H1) |
| 2 | 191 474 H1 | PLUG |
| 3 | 191 477 H1 | GASKET, plug |
| 4 | 191 475 H1 | SPRING |
| 5 | 191 476 H1 | VALVE |
| 6 | 302 565 R1 | GASKET |
| 7 | 302 574 R91 | PACKAGE, oil filter element (Consists of ELEMENT & GASKET 302 565 R1) |
| 8 | 880 625 C1 | STUD, center |
| 9 | 132 543 H1 | RING, retaining |
| 10 | 302 571 R1 | GASKET, center stud |
| 11 | 131 566 H1 | RETAINER, element |
| 12 | 313 021 R1 | SPRING, retainer |
| 13 | 302 567 R1 | GASKET, center stud |
| 14 | 165 714 H1 | PLUG, drain |
| 15 | 302 570 R1 | WASHER |
| 16 | 880 624 C91 | OIL FILTER SHELL & STUD (Composed of 1 GASKET 302 571 R1; 1 GASKET 302 567 R1; 1 PLUG 165 714 H1; 1 RETAINER 131 566 H1; 1 RING 132 543 H1; 1 SPRING 313 021 R1; 1 STUD 880 625 C1; 1 WASHER 302 570 R1) |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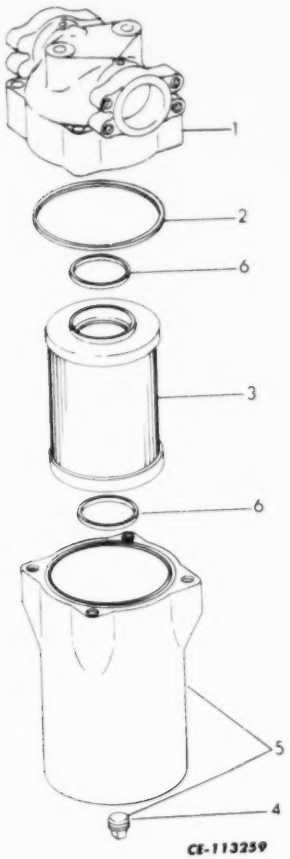
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CONVERTER LINE OIL FILTER** |

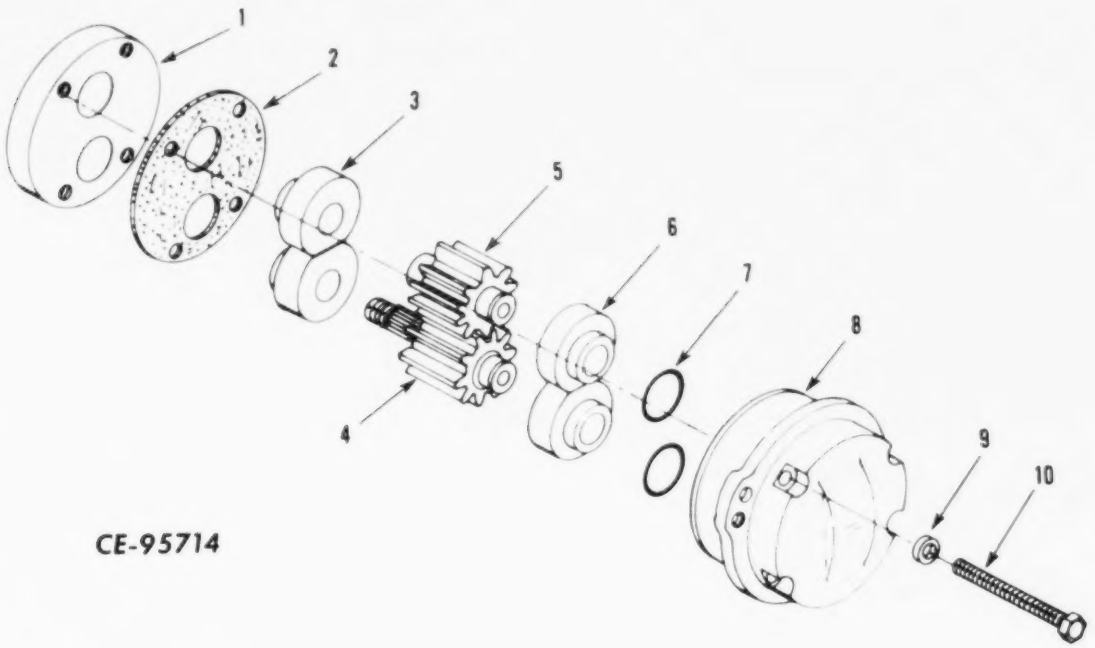



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 2 | 896 813 C1 | SEAL, housing |
| 3 | 896 811 C1 | ELEMENT, filter |
| 4 | 445 686 | PLUG |
| 5 | 940 466 C91 | HOUSING w/PLUG, 445 686 |
| 6 | 25 021 R1 | "O" RING (B) (2) |
| | 1 102 124 C1 | BRACKET (Listed and illustrated in Transmission & Torque Converter Lines) |

| | | |
|---|---|---|
| A | 893 287 C91 | OIL FILTER ASSEMBLY<br>U001180 to 1708<br>C001229 to 1720 |
| | | (Order the following parts -<br>1 FILTER 1 102 126 C91<br>1 BRACKET 1 102 124 C1 ) |
| B | 1 102 126 C91 | OIL FILTER ASSEMBLY<br>U001709 and up<br>C001721 and up |
| 1 | | HEAD (Not furnished separately) (A) |
| | 179 866 | SCREW, hex-hd cap (4) |
| 1 | | HEAD (Not furnished separately) (B) |
| | 203 762 R1 | SCREW, hex-hd cap (4) |
| | 446 211 | WASHER, flat (4) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

CHARGING PUMP
U001179 and below
C001228 and below




CE-95714

| | | |
|---|---|---|
| | 187 588 H3 | PUMP, input (30 GPM) (Consists of the following - |
| 1 | | COVER (Not furnished separately) |
| 2 | | GASKET (*) (≠) (%) |
| 3 | | BUSHING, shoulder (*) (≠) (2) |
| 4 | | GEAR, drive (≠) |
| 5 | | GEAR, driven (≠) |
| 6 | | BUSHING, shoulder (*) (≠) (2) |
| 7 | | "O" RING (*) (≠) (%) (2) |
| 8 | | BODY (Not furnished separately) |
| 9 | | WASHER, special (Not furnished separately) (4) |
| 10 | | BOLT (Not furnished separately) (4) |
| | 889 473 C1 | KIT, seal and bushing (Consists of - § 4 BUSHING § 1 GASKET § 2 "O" RING ) |
| | 889 474 C1 | KIT, gear and bushing (Consists of - § 4 BUSHING § 1 DRIVE GEAR § 1 DRIVEN GEAR § 1 GASKET § 2 "O" RING ) |
| | 889 470 C1 | KIT, seal and gasket (Consists of GASKET and two "O" RING) |

(*) - Part of Seal and Bushing Kit, 889 473 C1.

(≠) - Part of Gear and Bushing Kit, 889 474 C1.

(%) - Part of Seal and Gasket Kit, 889 470 C1.

(§) - Not Furnished Separately.



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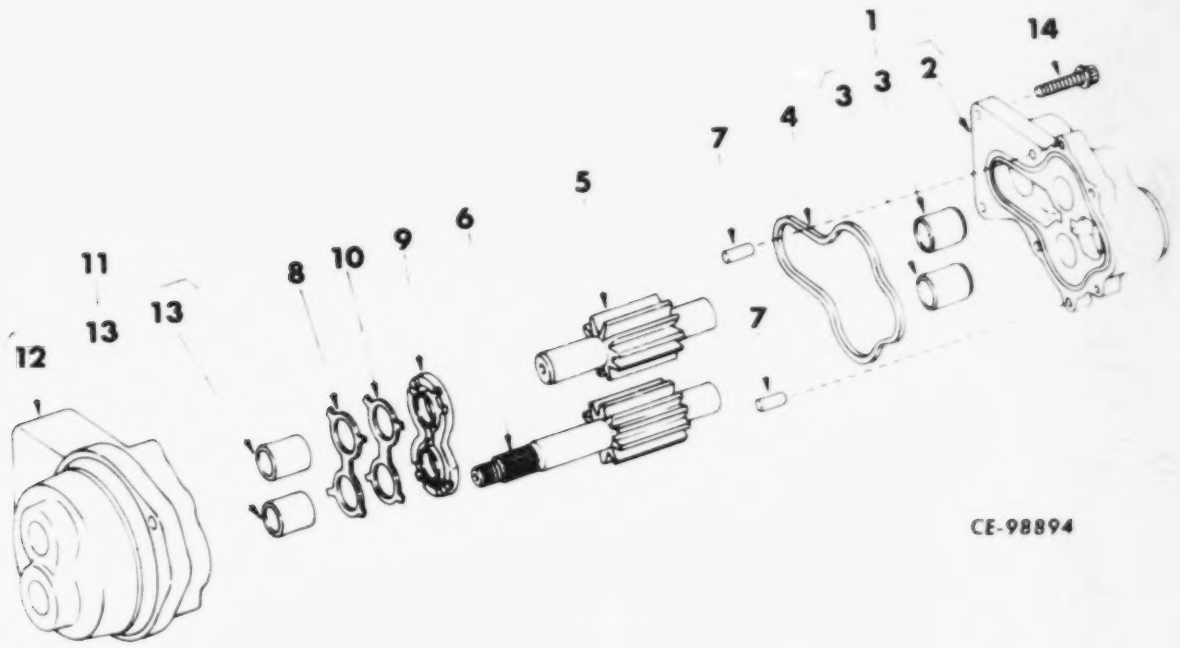
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

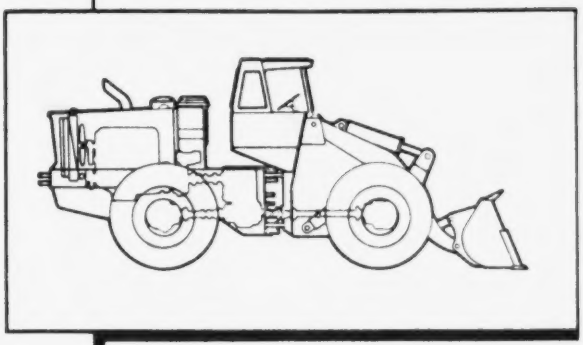
CHARGING PUMP
U001180 and up
C001229 and up




| | | |
|---|---|---|
| | 921 806 C91 | PUMP, charging (30 G.P.M.) (Consists of the following - |
| 1 | 922 313 C91 | COVER ASSEMBLY |
| 2 | | COVER (Not furnished separately) |
| 3 | 922 312 C1 | BUSHING (2) |
| 4 | 922 320 C1 | GASKET, seal |
| 5 | 923 151 C1 | GEAR, driven |
| 6 | 923 150 C1 | GEAR, drive |
| 7 | 141 242 | PIN, dowel (2) |
| 8 | 922 319 C1 | SEAL, rulon |
| 9 | 922 316 C1 | PLATE, wear |
| 10 | 922 317 C1 | SEAL, pressure loading |
| 11 | 923 149 C91 | BODY ASSEMBLY |
| 12 | | BODY (Not furnished separately) |
| 13 | 922 312 C1 | BUSHING (2) |
| 14 | 347 755 R1 | SCREW, ferry head cap (6) |
| | 615 029 R1 | WASHER (6) |
| | 16 008 R1 | BALL, 1/4" |

# SECTION 8

# ELECTRICAL



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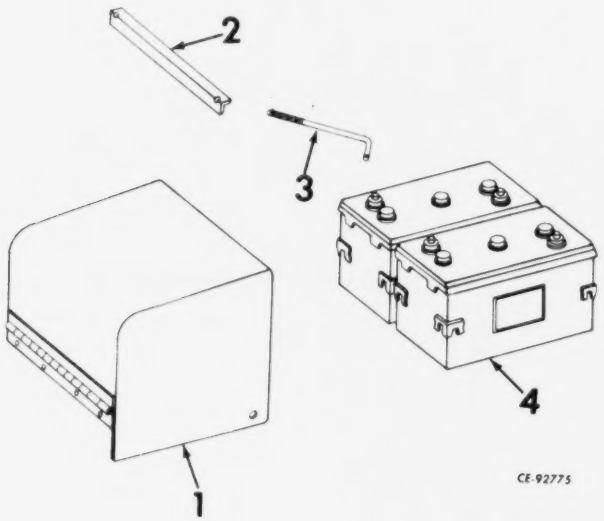
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

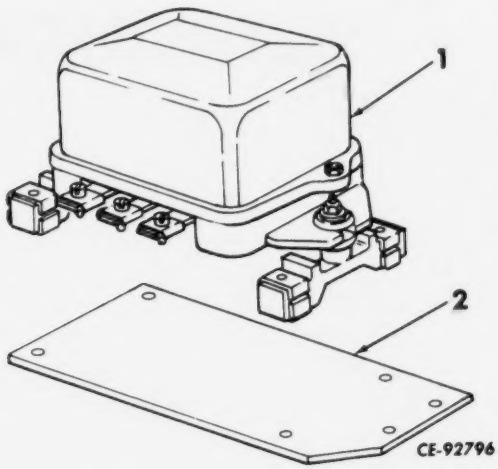
BATTERY AND MOUNTING




| | | |
|---|---|---|
| 1 | 195 698 H1 | COVER, right hand |
| 1 | 195 699 H1 | COVER, left hand |
| | 181 364 | 3/8NF x 1" BOLT (8) |
| | 120 382 | 3/8" lock WASHER (8) |
| | 103 026 | 3/8"NF hex NUT (8) |
| | 103 341 | 3/8" flat WASHER (8) |
| | 258 222 R92 | LATCH (2) |
| 2 | 196 944 H1 | ANGLE, battery retainer (2) |
| 3 | 201 873 H1 | BOLT, angle (Used with BATTERY, 7907X) (4) |
| 3 | 935 803 C1 | BOLT, angle (Used with BATTERY, 1424X) |
| | 106 261 | 1/4" flat WASHER (4) |
| | 103 319 | 1/4" lock WASHER (4) |
| | 20 090 R1 | 1/4"NF - 28 NUT (4) |
| | 103 361 | 1/16 x 1/2" PIN (4) |
| 4 | | BATTERY (6-Volt Presto Lite 1424X) (4) |
| | 153 518 H1 | CLAMP, battery cover (2) |
| | 168 753 H1 | SCREW (6) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

REGULATOR BRACKET
(Cummins Engine)




| | | |
|---|---|---|
| 1 | | REGULATOR, voltage (See Cummins Engine Manual) |
| | 181 318 | 1/4NF x 1-3/8" BOLT (4) |
| | 103 319 | 1/4" lock WASHER (4) |
| | 103 024 | 1/4" NF NUT (4) |
| 2 | 199 902 H2 | BRACKET, voltage regulator |
| | 179 879 | 1/2NC x 3/4" BOLT (2) |
| | 103 323 | 1/2" lock WASHER (2) |
| | 106 265 | 1/2" flat WASHER (2) |



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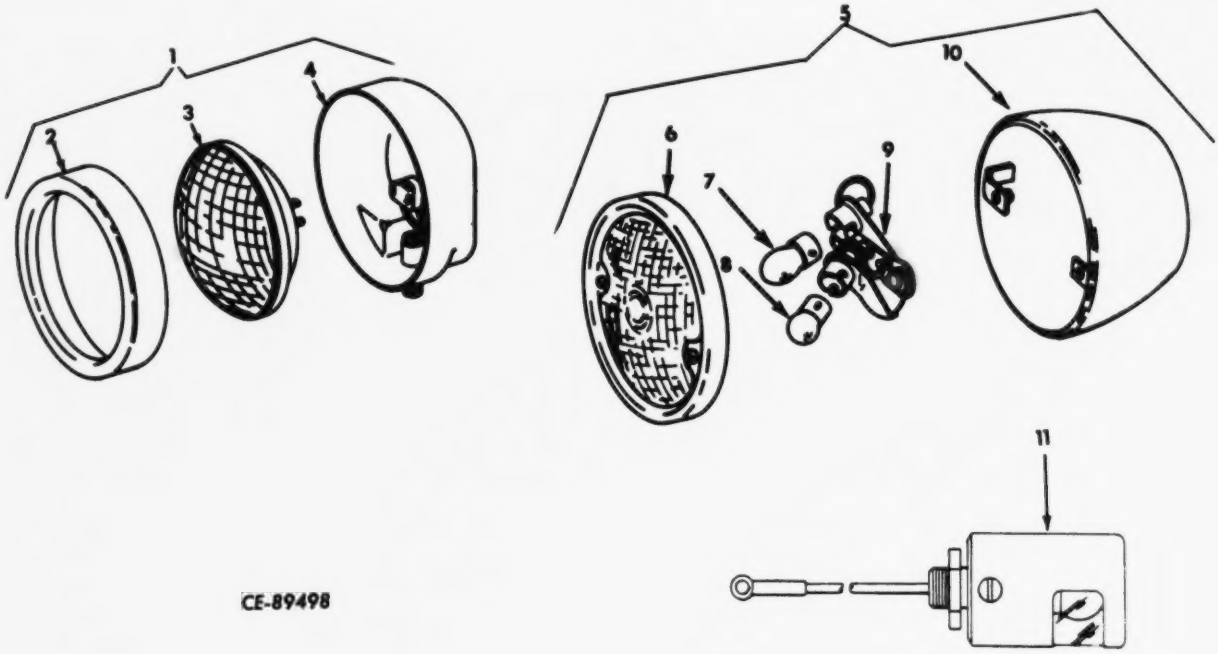
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

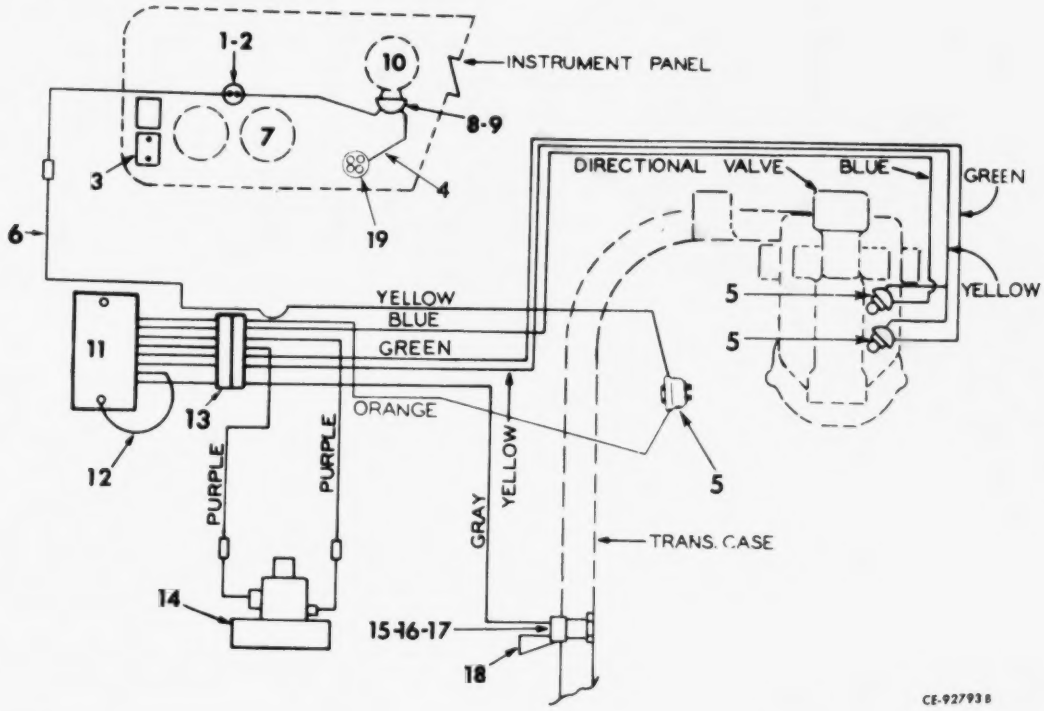
LIGHTING




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 176 852 H1 | LAMP ASSEMBLY, (Front & Rear) (Order Lamp 338 814 R91) (4) |
| 2 | 313 957 R1 | RETAINER |
| 3 | 273 560 | SEALED BEAM (G.E. Trade No. 4578) |
| 4 | | BODY, (Not Serviced Separately) |
| | 177 359 H1 | SUPPORT, front light (2) |
| | 177 360 H1 | SUPPORT, rear light (2) |
| | 219 778 | 1-1/4" NF jam NUT (2) |
| | 131 085 | 1-1/4 lock WASHER (2) |
| | 882 790 C1 | PLUG, rubber w/3/32" hole (8) |
| | 176 750 H1 | CLAMP (4) |
| | 173 443 H1 | SCREW, set (4) |
| | 18 452 R1 | NUT, Esna 1/2"NF - 20 |
| | 176 749 H1 | WASHER (8) |
| 5 | 324 352 R91 | LIGHT ASSEMBLY, (Tail & Stop 24-28V) (2) |
| | 121 749 | SCREW, No. 8 x 5/16" slt-rd head mach (2) |
| | 121 841 | WASHER, No. 8 lock (2) |
| | 142 247 | NUT, 1/4-28 hex (2) |
| | 120 380 | WASHER, 1/4" lock (2) |
| 6 | 313 749 R91 | DOOR |
| | 44 527 | SCREW, door assembly to body (2) |
| 7 | | BULB, stop lite trade (G.E. No. 1683) |
| 8 | | BULB, tail lite trade (G.E. No. 623) |
| 9 | | SOCKET & PLATE (Not furnished Separately) |
| 10 | | BODY, (Not Serviced Separately) |
| | 168 344 H1 | SCREW, stop light terminal (4) |
| | 121 841 | WASHER, lock, stop light terminal |
| | 179 095 H1 | BRACKET, LH stop light |
| | 179 096 H1 | BRACKET, RH stop light |
| | 140 226 H1 | WASHER (2) |
| | 103 319 | 1/4" WASHER, lock (4) |
| | 103 024 | 1/4" hex NUT (4) |
| 11 | 154 466 H1 | LAMP ASSEMBLY, dash (Used on units not equipped with back lighting on air core gauges) |
| | | BULB, trade (No. 303) GE 28-Volts (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

SHIFT MODULATOR SYSTEM
U001223 and below except 01220
C001254 and below




| | | |
|---|---|---|
| 1 | 881 324 C1 | HOLDER, fuse |
| 2 | 145 510 | FUSE, lamp (3AG x 1 amp) |
| 3 | | BREAKER, circuit (See Wiring in this Section) |
| 4 | | WIRE (See Wiring in this Section) |
| 5 | 885 441 C2 | SWITCH, pressure (3) |
| 6 | 884 180 C1 | WIRE, jumper |
| 7 | | GAUGE, Trans Clutch Pressure (See Electrical Gauges in Section 11) |
| 8 | 879 677 C1 | SWITCH, air pressure |
| 9 | 121 761 | TEE |
| 10 | | GAUGE, air pressure (See Electrical Gauges in Section 11) |
| 11 | 881 327 C2 | CONTROL |
| | 181 319 | 1/4NF x 1-1/2" BOLT (2) |
| | 103 339 | 1/4" flat WASHER (2) |
| | 19 776 | 1/4"NF hex, NUT (2) |
| | 152 711 H1 | 1/4" lock WASHER (2) |
| 12 | | WIRE, Ground to Mounting Bolt (White) |
| 13 | 889 950 C1 | WIRING HARNESS |
| 14 | | VALVE, solenoid (See Solenoid Valve in Section 3) |
| 15 | 426 094 | SET SCREW (2) |
| 16 | 878 137 C91 | MAGNETIC, pick-up |
| 17 | 878 194 C1 | ADAPTER, pick-up to cover (See Transmission in Section 7) |
| 18 | | WIRE, ground to cable clamp (White) |
| 19 | | SWITCH, ignition (See Wiring in this Section) |



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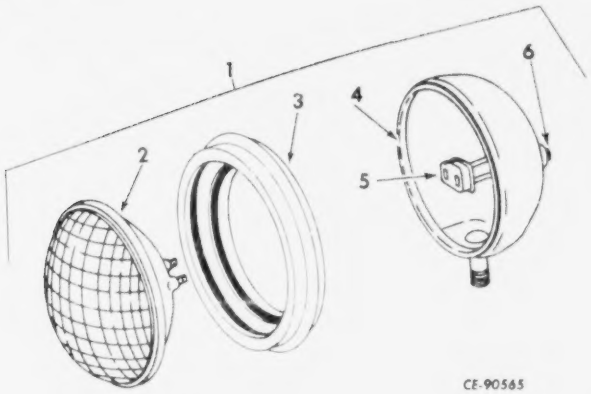
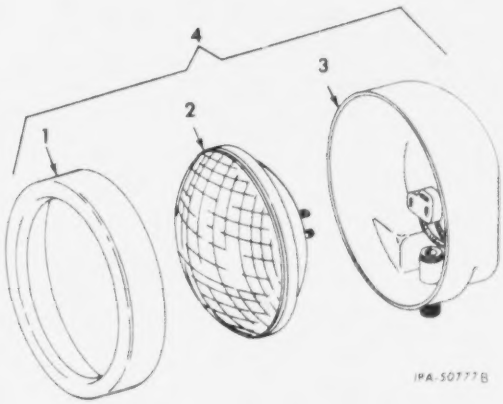
## FRONT & REAR LAMP ASSEMBLY



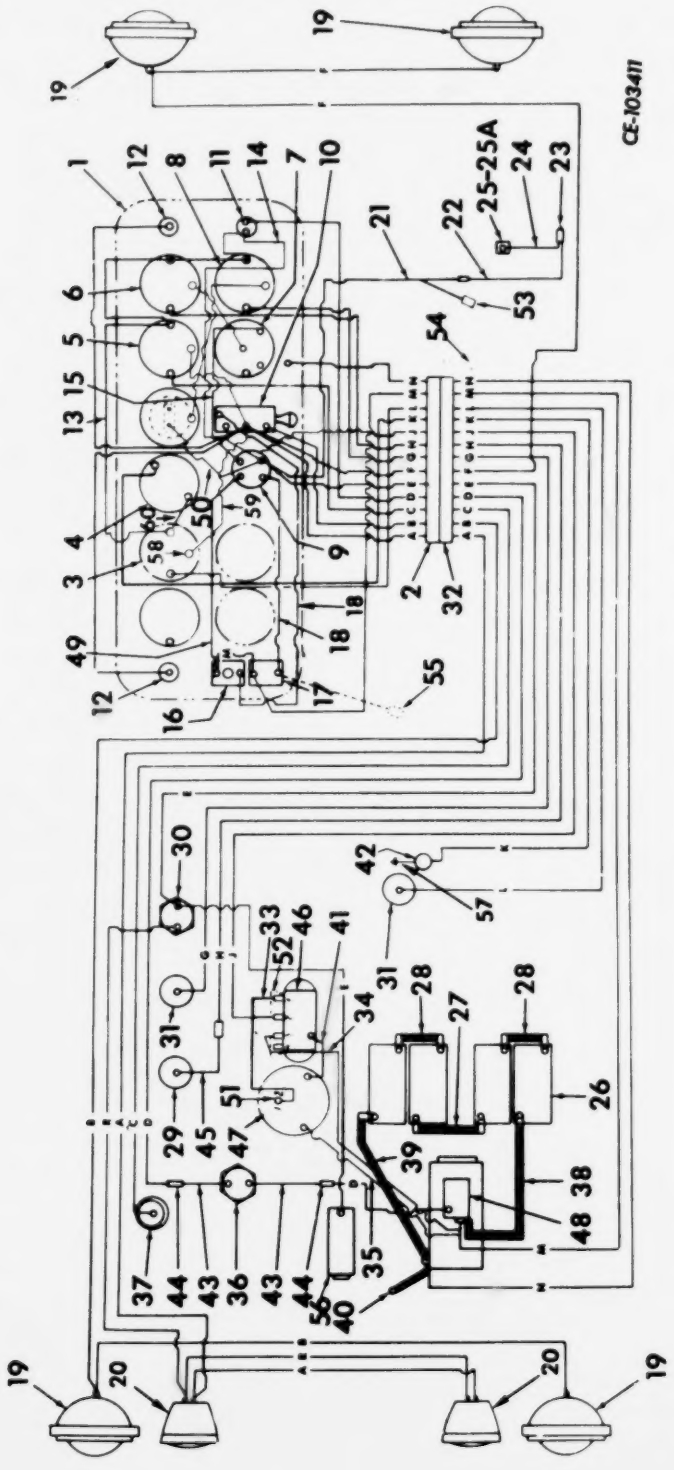

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 338 814 R91 | LAMP ASSEMBLY (4) |
| 2 | 273 560 | SEALED UNIT (G.E. Trade No. 4578) |
| 3 | 338 896 R1 | RETAINER |
| 4 | | BODY (Not furnished separately) |
| 5 | | CONNECTOR & WIRING (Not furnished separately) |
| 6 | | TERMINAL (Not furnished separately) |

## LOW LEVEL HEAD LAMP ASSEMBLY




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 313 957 R1 | RETAINER |
| 2 | 273 560 | LAMP (G.E. 4578) |
| 3 | | SHELL ASSEMBLY (Not furnished separately) |
| 4 | 176 852 H1 | LAMP ASSEMBLY, front driving (2) |

WIRING
(Cummins)



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **WIRING - Continued (Cummins)** | | |
| 1 | | INSTRUMENT PANEL (See Instrument Panel in Section 11) |
| 2 | 196 806 H3 | HARNESS, instrument |
| 3 | | GAUGE, torque converter temperature (See Instruments and Related Parts in Section 11) |
| 4 | | HOURMETER (See Instruments and Related Parts in Section 11) |
| 5 | | GAUGE, fuel (See Instruments and Related Parts in Section 11) |
| 6 | | GAUGE, engine oil pressure (See Instruments and Related Parts in Section 11) |
| 7 | | VOLTMETER (See Instruments and Related Parts in Section 11) |
| 8 | | GAUGE, water temperature (See Instruments and Related Parts in Section 11) |
| 9 | 877 123 C91 | SWITCH, ignition |
| 10 | 107 749 H1 | SWITCH, light |
| 11 | 453 453 C1 | SWITCH, push button starter (Replaces 627 670 C1) |
| 12 | | LIGHT, dash (See Lighting in this Section) |
| 13 | 890 668 C1 | JUMPER, wire |
| 14 | 140 719 H1 | WIRE, ignition switch to push button starter |
| 15 | 103 815 H1 | WIRE, main switch to voltmeter |
| 16 | 124 087 H1 | BREAKER, circuit (10 amp) |
| | 132 776 | No. 8 x 1" slt-nd-hd-mach SCREW (4) |
| | 121 841 | No. 8 lock WASHER (4) |
| | 120 622 | No. 8 -32 hex NUT (4) |
| 17 | 140 758 H1 | BREAKER, circuit |
| 18 | 884 684 C1 | WIRE, circuit breaker to switch (2) |
| 19 | | LIGHT, driving (See Lighting in this Section)(4) |
| 20 | | LAMP, rear stop and tail (See Lighting in this Section) (2) |
| 21 | 215 232 H1 | WIRE, ignition switch to warning light |
| 22 | 215 233 H1 | WIRE |
| 23 | 183 135 H1 | SWITCH, parking brake |
| | 181 326 | 5/16NF x 3/4" BOLT |
| | 103 320 | 5/16" lock WASHER |
| | 173 127 | 5/16" star WASHER |
| | 103 025 | 5/16"NF hex NUT |
| | 103 340 | 5/16" flat WASHER |
| 24 | 211 025 H1 | WIRE, switch to parking brake light |
| 25 | 925 937 C91 | LIGHT, w/BULB, 24 006 R1, Parking brake warning |
| 25A | 211 022 H1 | BRACKET |
| | 181 309 | 1/4NF x 1/2" BOLT |
| | 106 261 | 1/4" flat WASHER |
| | 103 319 | 1/4" lock WASHER |
| 26 | | BATTERY (See Batteries and Mounting in this Section) |
| 27 | 196 978 H1 | CABLE, battery jumper |
| 28 | 116 949 H1 | CABLE, battery jumper (2) |
| 29 | | SENDER, engine oil pressure (See Instruments and Related Parts in Section 11) |
| 30 | 112 339 H2 | SWITCH, stop lights |
| 31 | | SENDER, water temperature (See Instruments and Related Parts in Section 11) (2) |
| 32 | 892 568 C1 | HARNESS, main |
| 33 | 884 191 C1 | WIRE, No. 2 terminal on alternator to "F" terminal on regulator |
| 34 | 892 612 C1 | WIRE, regulator to steering solenoid |
| 35 | 892 611 C1 | WIRE, alternator to steering solenoid |
| 36 | 875 181 C1 | SWITCH, neutral safety |
| 37 | | SENDER, fuel (See Fuel System in Section 12) |
| 38 | 881 635 C1 | CABLE, battery to starter (3) |
| 39 | 881 636 C1 | CABLE, battery to ground (-) |
| 40 | 183 039 H1 | CABLE, starter to ground |
| 41 | 117 241 H1 | CABLE, ground (alternator) |
| 42 | 208 622 H2 | SWITCH, hourmeter (Used on units equipped with Hourmeter) |
| 43 | 886 433 C1 | CABLE, neutral safety switch (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **WIRING - Continued (Cummins)** |
| 44 | 113 868 H1 | CONNECTOR (2) |
| 45 | 885 241 C1 | CABLE, harness to oil sender (Used with HARNESSES, 877 877 C2 and 892 071 C1) |
| 46 | | REGULATOR (See Cummins Engine Manual) |
| 47 | | ALTERNATOR (See Cummins Engine Manual) |
| 48 | | STARTER (See Cummins Engine Manual) |
| 49 | 214 272 H1 | WIRE, jumper |
| 50 | 134 319 H1 | WIRE, ignition switch to air pressure switch<br>U001223 and below except 01220<br>C001254 and below |
| 51 | 969 541 R1 | CONNECTOR, lock |
| 52 | 969 325 R1 | CONNECTOR, lock |
| 53 | | WIRE (To heater when used) |
| 54 | | NOT USED - Taped back |
| 55 | | WIRE (For shift modulator) (Refer to "Shift Modulator System" in this Section) |
| 56 | | SOLENOID, fuel (See Cummins Engine Manual) |
| 57 | 136 395 H1 | CABLE, hourmeter ground (Used on units equipped with Hourmeter) |
| 58 | 20 274 R1 | LAMP (Used on units equipped with back lighting on air core gauges (6) |
| 59 | 893 051 C1 | HARNESS, gauge (Used on units equipped with back lighting on air core gauges) |
| 60 | | NOT USED (Taped Back) |
| | 158 159 H1 | CLAMP, wiring harness to frame (2) |
| | 24 006 R1 | BULK, parking brake warning trade 28V (G.E. 303) |
| | 132 908 | SCREW, ground (6) |
| | 106 497 | WASHER, lock (6) |
| | 103 088 | NUT (6) |
| | 136 139 H1 | CLAMP, harness to rear frame |
| | 138 459 H1 | CLAMP, front driving light wire to angle (3) |
| | 129 668 H1 | CLAMP, wiring harness at converter to flywheel housing (3) |
| | 610 213 C91 | STRAP, harness to upper hydraulic hose |
| | 181 431 | BOLT, 1/2NF x 1-1/2" starter ground |
| | 163 839 H1 | WASHER, shakeproof, starter ground (2) |
| | 103 028 | NUT, 1/2NF, starter ground |
| | 141 453 H1 | CLAMP, harness to frame (3) |
| | 102 634 | NUT, 5/16NC, stud on frame (3) |
| | 103 320 | WASHER, lock 5/16NC, stud on frame (3) |
| | 615 031 R1 | WASHER, flat 5/16", stud on frame |
| | 181 315 | BOLT, 1/4NF x 1, harness to frame (2) |
| | 103 024 | NUT, hex 1/4NF (2) |
| | 103 319 | WASHER, lock 1/4" (2) |
| | 103 026 | NUT, 3/8NF |
| | 103 321 | WASHER, lock 3/8" |
| | 102 818 H1 | CLAMP, cable |
| | 181 331 | BOLT, 5/16NF x 1/2" |
| | 103 320 | WASHER, lock 5/16" |
| | 204 732 H1 | CLAMP, battery cable |
| | 154 055 H1 | CLIP |
| | 107 544 H1 | GROMMET |
| | 615 031 R1 | WASHER, flat, stud on front frame (4) |
| | 143 142 H1 | CLAMP, harness to hose and link support |
| | 167 685 H1 | GROMMET, battery cable thru bulkhead (2) |
| | 206 413 H1 | BAR |
| | 179 835 | BOLT, 3/8NC x 5/8" |
| | 103 321 | WASHER, lock 3/8" |

*Serial number not available.



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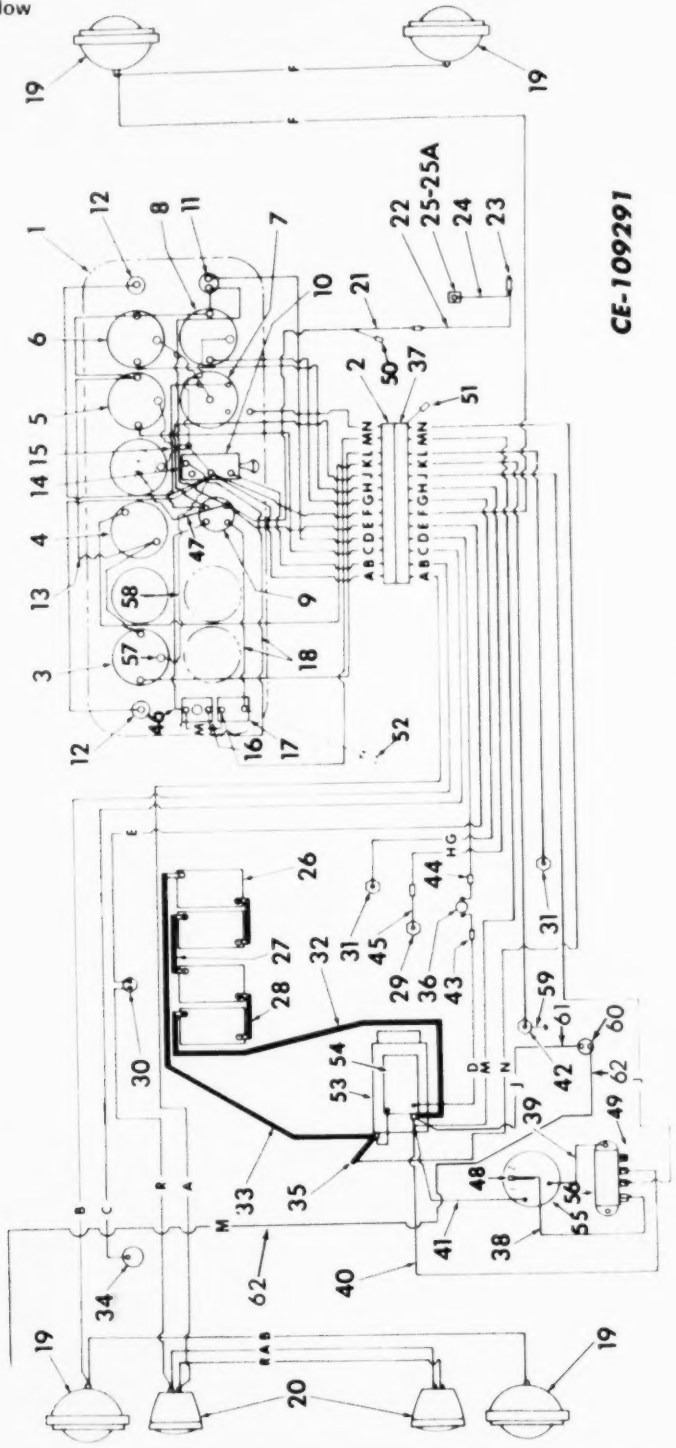
MEMORANDA

WIRING
(I.H. ENGINE)
U001187 and below
C001195 and below



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **WIRING - Continued (I.H. Engine) U001187 and below C001195 and below** |
| 1 | | INSTRUMENT, panel (See Instrument Panel in Section 11) |
| 2 | 196 806 H5 | HARNESS, instrument |
| 3 | | GAUGE, torque converter temperature (See Instrument and Related Parts in Section 11) |
| 4 | | GAUGE, hourmeter (See Instrument Gauges in Section 11) |
| 5 | | GAUGE, fuel (See Instrument and Related Parts in Section 11) |
| 6 | | GAUGE, engine oil pressure (See Instrument and Related Parts in Section 11) |
| 7 | | VOLTMETER (See Instrument and Related Parts in Section 11) |
| 8 | | GAUGE, water temperature (See Instrument and Related Parts in Section 11) |
| 9 | 877 123 C91 | SWITCH, ignition |
| 0 | 107 749 H1 | SWITCH, light |
| 1 | 453 453 C1 | SWITCH, push button starter (Replaces 627 670 C1) |
| 2 | | LIGHT, dash (See Lighting in this Section) (2) |
| 3 | 196 943 H3 | JUMPER, instrument |
| 14 | 140 719 H1 | WIRE, ignition switch to push button starter |
| 15 | 103 815 H1 | WIRE, ignition switch to voltmeter |
| 16 | 124 087 H1 | BREAKER, circuit |
| | 132 776 | No. 8 x 1" slt-rd-hd-mach SCREW (4) |
| | 121 841 | No. 8 lock WASHER (4) |
| | 120 622 | No. 8-32 hex NUT (4) |
| | 27 648 R1 | No. 8-32 x 3/8" slt-pan-hd-mach SCREW |
| 17 | 140 758 H1 | BREAKER, circuit |
| | 27 648 R1 | No. 8-32 x 3/8" slt-pan-hd-mach SCREW |
| 18 | 884 684 C1 | WIRE, circuit breaker to ignition switch (2) |
| 19 | | LIGHT, driving (See Lighting in this Section) (4) |
| 20 | | LAMP, rear stop and tail (See Lighting in this Section) (2) |
| 21 | 215 232 H1 | CABLE, ignition switch to warning light |
| 22 | 215 233 H1 | CABLE, junction |
| 23 | 183 135 H1 | SWITCH, parking brake |
| | 181 336 | 5/16NF x 3/4" BOLT |
| | 120 214 | 5/16" lock WASHER |
| | 178 532 | 5/16" star WASHER |
| | 103 025 | 5/16"NF hex NUT |
| | 103 340 | 5/16" flat WASHER (4) |
| 24 | 211 025 H1 | CABLE, switch to parking brake light |
| 25 | 925 937 C91 | LIGHT w/BULB, 24 006 R1 parking brake warning |
| 25A | 211 022 H1 | BRACKET |
| | 181 309 | 1/4NF x 1/2" BOLT |
| | 106 261 | 1/4" flat WASHER |
| | 103 319 | 1/4" lock WASHER |
| 26 | | BATTERY (See Batteries and Mounting in this Section) (4) |
| 27 | 196 978 H1 | CABLE, battery jumper |
| 28 | 116 949 H1 | CABLE, battery jumper (2) |
| 29 | | SENDER, engine oil pressure (See Instrument and Related Parts in Section 11) |
| 30 | 112 339 H2 | SWITCH, stop light |
| 31 | | SENDER, water temperature (See Instrument and Related Parts in Section 11) (2) |
| 32 | 881 635 C1 | CABLE, battery to starter (+) |
| 33 | 881 636 C1 | CABLE, battery to ground (-) |
| 34 | | SENDER, fuel gauge (See Fuel System in Section 12) |
| 35 | 183 039 H1 | CABLE, starter to ground |
| 36 | 875 181 C1 | SWITCH, neutral safety |
| 37 | 892 567 C1 | ENGINE, harness (Will work for HARNESS, 213 979 H3) |
| 38 | 884 191 C1 | WIRE, No. 2 terminal on alternator to "F" terminal on regulator |
| 39 | 117 241 H1 | WIRE, ground |
| 40 | 884 189 C1 | WIRE, regulator to starter solenoid |
| 41 | 884 188 C1 | WIRE, alternator to starter solenoid |
| 42 | 208 622 H2 | SWITCH, hourmeter |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | WIRING - Continued (I.H. Engine) U001187 and below C001195 and below |
| 43 | 113 868 H1 | CONNECTOR (2) |
| 44 | 886 433 C1 | CABLE, neutral safety switch (2) |
| 45 | 885 241 C1 | WIRE, harness to oil sender (Used with HARNESS, 213 979 H3) |
| 46 | 214 272 H1 | WIRE, jumper |
| 47 | 134 319 H1 | WIRE, ignition switch to air pressure switch |
| 48 | 969 541 R1 | CONNECTOR, lock |
| 49 | 969 325 R1 | CONNECTOR, lock |
| 50 | | WIRE (To heater when used) |
| 51 | | NOT USED (Taped back) |
| 52 | | WIRE (For shift modulator) (Refer to "Shift Modulator System" in this Section) |
| 53 | | MOTOR, cranking (Refer to EPC-817B or 817-C Engine Manual) |
| 54 | | SOLENOID, starter (Refer to EPC-817B or 817C Engine Manual) |
| 55 | | ALTERNATOR (Refer to EPC-817B or 817C Engine Manual) |
| 56 | | REGULATOR, voltage (See Voltage Regulator in this section) |
| 57 | 20 274 R1 | LAMP (Used on units equipped with back lighting for air core gauges) (6) |
| 58 | 893 051 C1 | HARNESS, gauge lights (Used on units equipped with back lighting for air core gauges) |
| 59 | 136 395 H1 | WIRE, hourmeter pressure switch ground |
| 60 | | SWITCH, pressure (Refer to BACK-UP ALARM KIT) |
| 61 | | CABLE, pressure switch to starter solenoid (Refer to BACK-UP ALARM KIT) |
| 62 | | CABLE, pressure switch to alarm (Refer to BACK-UP ALARM KIT) |
| | 24 006 R1 | BULB, parking brake warning .28V (G.E. 303) |
| | 129 083 R1 | CLAMP, cable to bulkhead |
| | 136 139 H1 | CLAMP, harness to rear frame |
| | 141 453 H1 | CLAMP, harness to frame and floorboard |
| | 143 142 H1 | CLAMP, harness to floorboard |
| | 158 159 H1 | CLAMP, wiring harness to frames (3) |
| | 161 043 H1 | CLAMP, wire to engine (2) |
| | 204 732 H1 | CLAMP, battery cable to bulkhead |
| | 263 515 R91 | CLAMP, front driving light wire to angle (2) |
| | 263 717 R91 | CLAMP, wiring harness at converter to flywheel housing (2) |
| | 263 717 R91 | CLAMP, parking brake switch wire to floorboard |
| | 167 685 H1 | GROMMET, battery cable thru bulkhead (2) |
| | 25 519 R1 | NUT, 1/4" (4) |
| | 25 520 R1 | NUT, 5/16" stud on frame (2) |
| | 25 523 R1 | NUT, 3/8" clamp to floorboard |
| | 103 028 | NUT, 1/2" starter ground |
| | 25 483 R1 | SCREW, 1/4" N.C. x 1" (2) |
| | 25 493 R1 | SCREW, 5/16" N.C. x 1" rear frame (2) |
| | 181 331 | SCREW, 5/16 N.F. x 1/2" |
| | 181 431 | SCREW, 1/2" N.F. x 1-1/3" starter ground |
| | 935 464 C1 | STRAP, harness to upper hydraulic hose (3) |
| | 935 522 C1 | STRAP, battery to starter cables (2) |
| | 935 522 C1 | STRAP, regulator and alternator to solenoid (2) |
| | 25 532 | WASHER, 9/32" I.D. flat (4) |
| | 25 542 R1 | WASHER, 11/32" I.D. flat (2) |
| | 25 533 R1 | WASHER, 5/16" flat (4) |
| | 120 214 | WASHER, 5/16" spring lock |
| | 25 534 R1 | WASHER, 3/8" flat clamp to floorboard |
| | 178 591 | WASHER, 1/2" tooth lock starter ground (2) |



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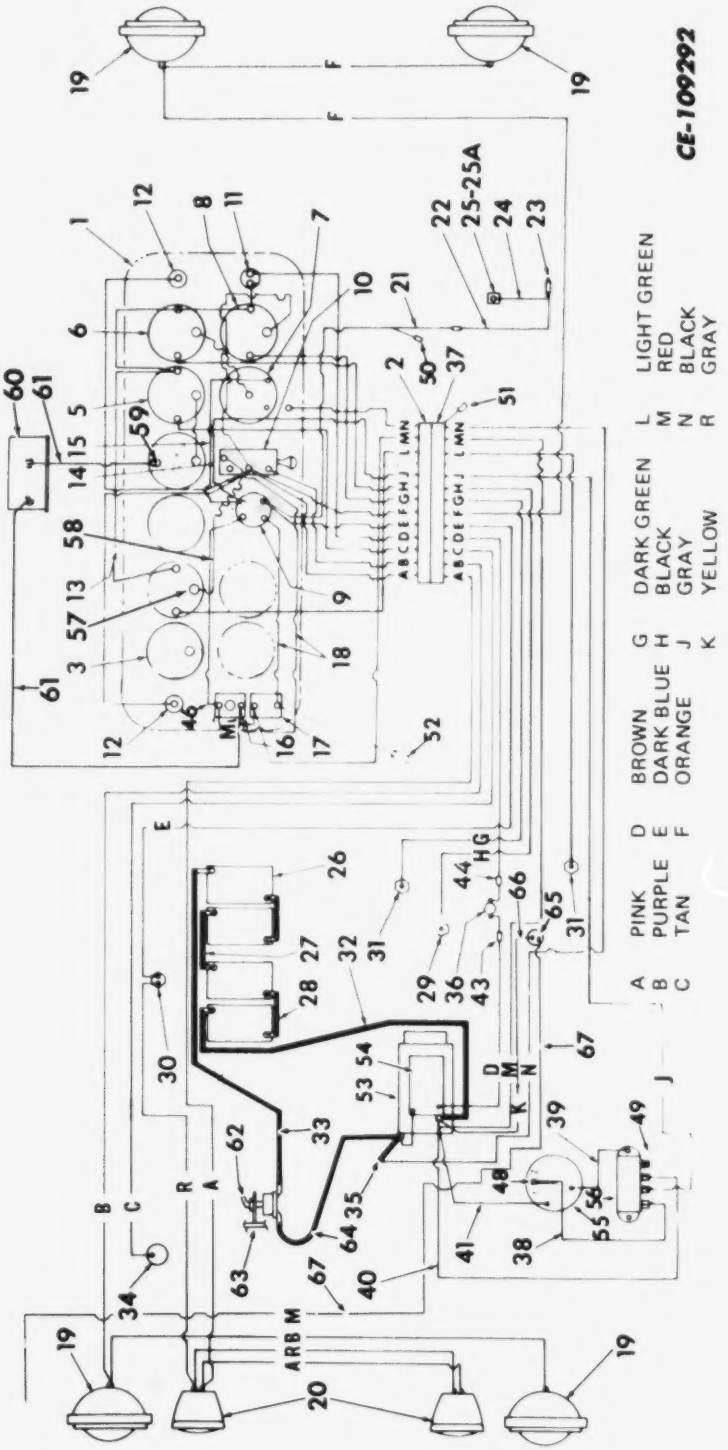
WIRING (I.H. ENGINE)
(1 Piece Harness)
U001188 and up
C001196 and up



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**WIRING (I.H. ENGINE) (Continued)**
**(1 Piece Harness)**
**U001188 and up**
**C001196 and up**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | INSTRUMENT, panel (See Instrument Panel in Section 11) |
| 2 | 921 871 C1 | HARNESS, instrument |
| 3 | | GAUGE, torque converter temperature (See Instruments and Related Parts in Section 11) |
| 5 | | GAUGE, fuel (See Instruments and Related Parts in Section 11) |
| 6 | | GAUGE, engine oil pressure (See Instruments and Related Parts in Section 11) |
| 7 | | VOLTMETER, (See Instruments and Related Parts in Section 11) |
| 8 | | GAUGE, water temperature (See Instruments and Related Parts in Section 11) |
| 9 | 877 123 C91 | SWITCH, Ignition |
| 10 | 107 749 H1 | SWITCH, light |
| 11 | 453 453 C1 | SWITCH, push button starter (Replaces 627 670 C1) |
| 12 | | LIGHT, dash (See Lighting in this Section) (2) |
| 13 | 890 668 C1 | JUMPER, instrument |
| 14 | | WIRE, harness (Not furnished separately) |
| 15 | 103 815 H1 | WIRE, ignition switch to voltmeter |
| 16 | 124 087 H1 | BREAKER, circuit |
| | 132 776 | SCREW, slt-rd-hd mach No. 8 x 1" (4) |
| | 121 841 | WASHER, lock No. 8 (4) |
| | 120 622 | NUT, hex No. 8-32 (4) |
| 17 | 140 758 H1 | BREAKER, circuit |
| 18 | 884 684 C1 | WIRE, circuit breaker to ignition switch (2) |
| 19 | | LIGHT, driving (See Lighting in this Section) (4) |
| 20 | | LAMP, rear stop and tail (See Lighting in this Section) (2) |
| 21 | 215 232 H1 | CABLE, Ignition Switch to Warning Light |
| 22 | 215 233 H1 | CABLE, junction |
| 23 | 183 135 H1 | SWITCH, parking brake |
| | 181 336 | BOLT, 5/16NF x 3/4" |
| | 120 214 | WASHER, lock 5/16" |
| | 178 532 | WASHER, star 5/16" |
| | 103 025 | NUT, hex 5/16NF |
| | 103 340 | WASHER, flat 5/16" (4) |
| 24 | 211 025 H1 | CABLE, switch to parking brake light |
| 25 | 925 937 C91 | LIGHT w/BULB, 24 006 R1, parking brake warning |
| 25A | 211 022 H1 | BRACKET |
| | 181 309 | BOLT, 1/4NF x 1/2" |
| | 106 261 | WASHER, flat 1/4" |
| | 103 319 | WASHER, lock 1/4" |
| 26 | | BATTERY (6-Volt) (Presto-Lite (7907X) (4) |
| 27 | 196 978 H1 | CABLE, battery jumper |
| 28 | 116 949 H1 | CABLE, battery jumper (2) |
| 29 | | SENDER, engine oil pressure (See Instruments and Related Parts in Section 11) |
| 30 | 112 339 H2 | SWITCH, stop light |
| 31 | | SENDER, water temperature (See Instruments and Related Parts in Section 11) (2) |
| 32 | 881 635 C1 | CABLE, battery to starter (+) |
| 33 | 881 636 C1 | CABLE, battery to ground (-) U001564 and below C0* and below |
| 33 | 99 153 HY | CABLE, battery to master switch (-) U001565 and up C0* and up |
| 34 | | SENDER, fuel gauge (See Instruments and Related Parts in Section 11) |
| 35 | 183 039 H1 | CABLE, starter to ground |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | WIRING (I.H. ENGINE) - Continued<br>(1Piece Harness)<br>U001188 and up<br>C001196 and up |
| 36 | 875 181 C1 | SWITCH, neutral safety |
| 37 | 921 872 C1 | ENGINE, harness |
| 38 | 884 191 C1 | WIRE, No. 2 terminal on alternator to "F" terminal on regulator (#) |
| 39 | 117 241 H1 | WIRE, ground<br>U001188 to *<br>C001196 to * |
| 39 | 895 302 C1 | WIRE, ground<br>U00 * and up<br>C00 * and up |
| 40 | 884 189 C1 | WIRE, regulator to starter solenoid (#) |
| 41 | 884 188 C1 | WIRE, alternator to starter solenoid |
| 43 | 886 433 H1 | WIRE, neutral safety switch (2) |
| 44 | 113 868 H1 | CONNECTOR (2) |
| 46 | 214 272 H1 | WIRE, jumper |
| 48 | 969 541 R1 | CONNECTOR, lock (#) |
| 49 | 969 325 R1 | CONNECTOR, lock (#) |
| 50 | | WIRE (To heater when used) |
| 51 | | Not Used (Taped back) |
| 52 | | WIRE (For Shift Modulator) (Refer to "Shift Modulator System" in this Section) |
| 53 | | MOTOR, cranking (Refer to EPC-817B or 817C Engine Manual) |
| 54 | | SOLENOID, starter (Refer to EPC-817B or 817C Engine Manual) |
| 55 | | ALTERNATOR (Refer to EPC-817B or 817C Engine Manual)<br>U001188 to *<br>C001196 to * |
| 55 | | ALTERNATOR w/INTERNAL VOLTAGE REGULATOR (Refer to EPC-817B or 817C Engine Manual)<br>U00 * and up<br>C00 * and up |
| 56 | | REGULATOR, voltage (See Voltage Regulator in this Section)<br>U001188 to *<br>C001196 to * |
| 57 | 20 274 R1 | LAMP (Used on Units Equipped with Back Lighting Air Core Gauges) (6) |
| 58 | 893 051 C1 | HARNESS, gauge lights (Used on Units Equipped with Back Lighting Air Core Gauges) |
| 59 | 140 207 H1 | SWITCH, low air pressure<br>U001256 and up<br>C001304 and up |
| | 444 012 | ADAPTER<br>U001256 and up<br>C001304 and up |
| 60 | 894 980 C1 | BUZZER<br>U001256 and up<br>C001304 and up |
| | 25 519 R1 | BOLT, 1/4NC x 5/8 (2) |
| | 25 532 R1 | WASHER, 1/4" lock (2) |
| | 25 480 R1 | NUT, 1/4"NC hex (2) |
| 61 | 895 293 C1 | HARNESS, buzzer<br>U001256 and up<br>C001304 and up |
| 62 | 930 587 C1 | SWITCH, master disconnect<br>U001565 and up<br>C0* and up |
| 63 | | BULKHEAD (Refer to BULKHEAD, COWLING and PANELS) |
| 64 | 932 196 C1 | CABLE, master switch to starter solenoid)<br>U001565 and up<br>C0* and up |
| 65 | | SWITCH, pressure (Refer to BACK-UP ALARM KIT) |
| 66 | | CABLE, pressure switch to starter solenoid) (Refer to BACK-UP ALARM KIT) |
| 67 | | CABLE, pressure switch to alarm (Refer to BACK-UP ALARM KIT) |
| | 24 006 R1 | BULB, parking brake warning .28V (GE 303) |

(#) - Used on Units equipped w/Remote Voltage Regulator
U001188 to *
C001196 to *

* - Serial Number Not Available.



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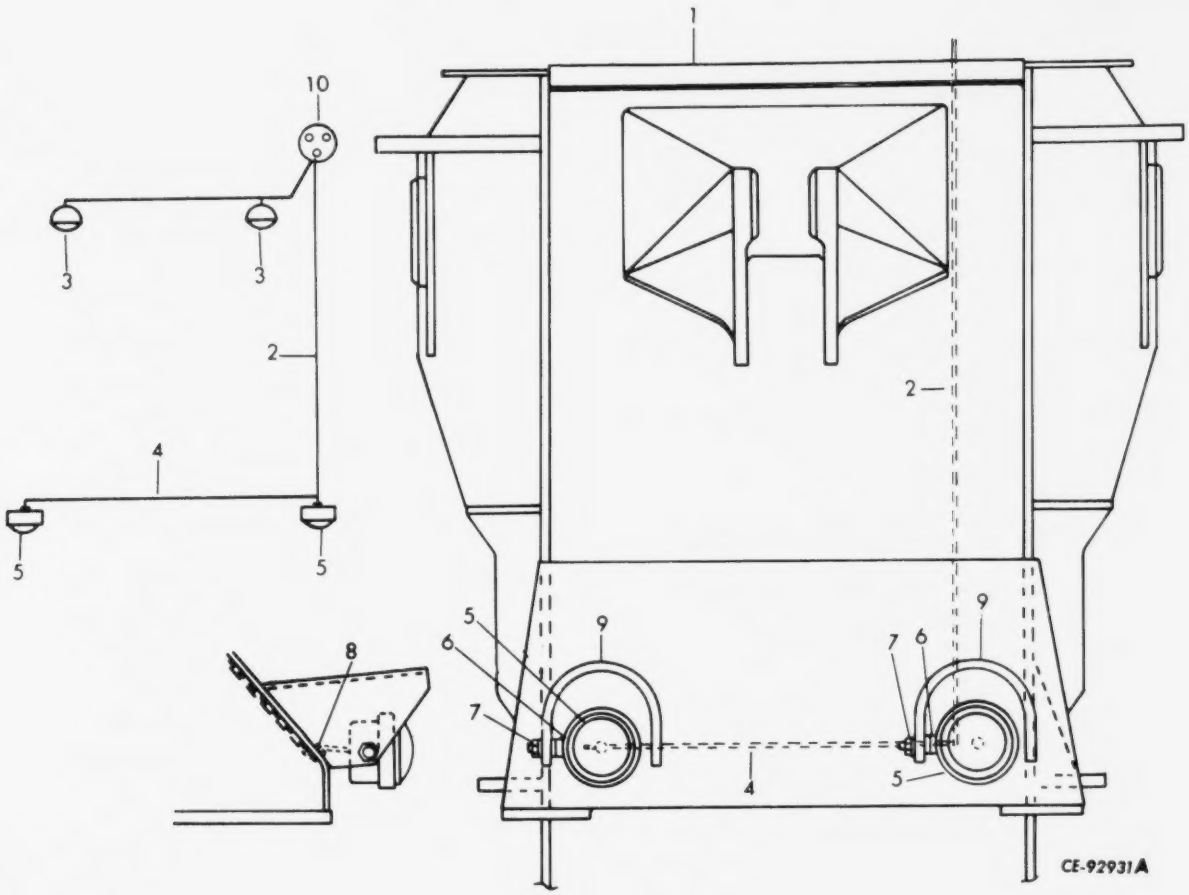
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

**WIRING (I.H. ENGINE) - Continued**
**(1 Piece Harness)**
**U001188 and up**
**C001196 and up**

| | | |
|---|---|---|
| | 161 043 H1 | CLAMP, wire to engine (2) |
| | 204 732 H1 | CLAMP, battery cable to bulkhead |
| | 263 515 R91 | CLAMP, front driving light wire to angle (2) |
| | 263 717 R91 | CLAMP, wiring harness to converter to flywheel housing (2) |
| | 263 717 R91 | CLAMP, parking brake switch wire to floorboard |
| | 167 685 H1 | GROMMET, battery cable thru bulkhead (2) |
| | 25 519 R1 | NUT, 1/4" (4) |
| | 25 520 R1 | NUT, 5/16" stud on frame (2) |
| | 25 523 R1 | NUT, 3/8" clamp to floorboard |
| | 103 028 | NUT, 1/2" starter ground |
| | 25 483 R1 | SCREW, 1/4" N.C. x 1" (2) |
| | 25 493 R1 | SCREW, 5/16" N.C. x 1" rear frame (2) |
| | 181 331 | SCREW, 5/16 N.F. x 1/2" |
| | 181 431 | SCREW, 1/2" N.F. x 1-1/2" starter ground |
| | 935 464 C1 | STRAP, harness to upper hydraulic hose (3) |
| | 935 522 C1 | STRAP, battery to starter cables (2) |
| | 935 522 C1 | STRAP, regulator and alternator to solenoid (2) |
| | 25 532 | WASHER, 9/32" I.D. flat (4) |
| | 25 542 R1 | WASHER, 11/32" I.D. flat (2) |
| | 25 533 R1 | WASHER, 5/16" flat (4) |
| | 120 214 | WASHER, 5/16" spring lock |
| | 25 534 R1 | WASHER, 3/8" flat clamp to floorboard |
| | 178 591 | WASHER, 1/2" tooth lock starter ground (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

LOW LEVEL HEAD LIGHT WIRING




Service Parts for Low Level Head Light Wiring

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | FRAME, front (See Main Frame in Section 9) |
| 2 | 878 011 C1 | CABLE |
| 3 | | LAMP, front driving (See Front Driving Lamp in this Section) |
| 4 | 877 586 C1 | CABLE, lamp to lamp |
| 5 | | LAMP, low level head (See Low level Head Lamp Assembly in this Section) (2) |
| 6 | 176 749 H1 | WASHER (4) |
| 7 | 18 452 R1 | NUT, 1/2" - 20NF Esna (2) |
| 8 | 109 692 H1 | BUSHING, rubber (2) |
| 9 | 877 857 C1 | SUPPORT (Part of Front Frame) (2) |
| 10 | | SWITCH (Refer to Wiring) |



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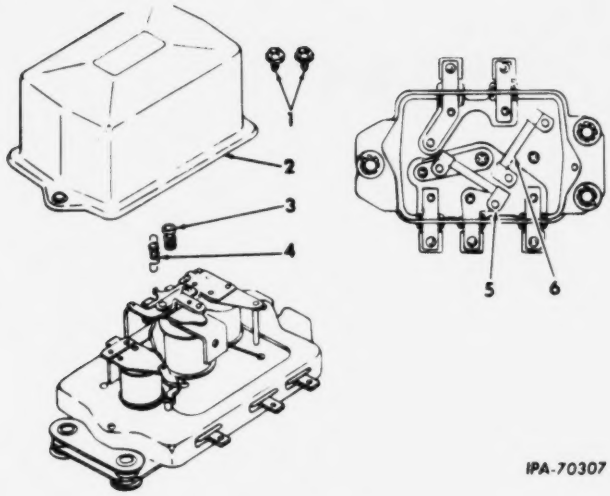
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

VOLTAGE REGULATOR (DT-817B and DT-817C Engine)
(Delco-Remy)
* and below

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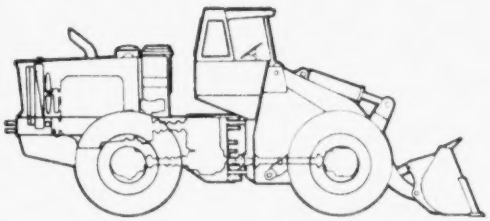
| | | |
|---|---|---|
| | 1 119 518 | REGULATOR ASSY, voltage (Consists of Ref. Nos. 1 thru 6) |
| 1 | 1 943 386 | SCREW, cover attaching (2) |
| 2 | | COVER, regulator (Not Furnished Separately) |
| 3 | 1 958 148 | SCREW, adjusting |
| 4 | 1 958 137 | SPRING, adjusting screw |
| 5 | 1 956 235 | RESISTOR |
| 6 | 1 960 347 | RESISTOR |

* - Serial Number Not Available.

# SECTION 9

# FRAME



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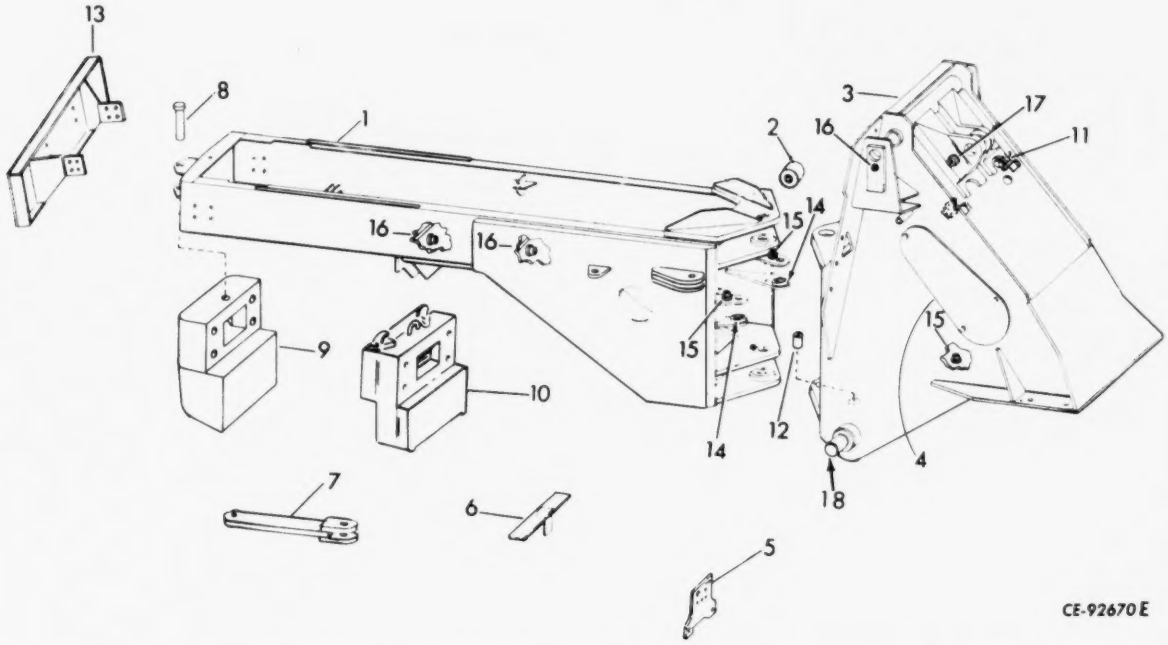
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

FRAME AND COUNTERWEIGHT




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 884 019 C2 | FRAME (Not used on units equipped with Reversible Engine Fan Kit) (See Note 2) rear w/two R.H. EARS, 194 486 H1) |
| 1 | 889 183 C1 | FRAME (Used on units equipped with Reversible Fan Kit) rear (See Note 2) |
| 2 | 216 294 H1 | BUMPER, steering (2) |
| | 181 434 | 1/2NF x 1-3/8" BOLT (2) |
| | 18 452 R1 | 1/2NF - 20 Esna NUT (2) |
| | 103 343 | 1/2" flat WASHER (2) |
| 3 | 929 783 C92 | FRAME, w/two BUSHINGS 212 332 H1 front (Not used on units equipped with Hydraulic Front Attachment Kit, Low Level Head Light Kit, or Loader to Logger Kit) |
| 3 | 888 779 C1 | FRAME, w/two BUSHINGS 212 332 H1, front (Used on units equipped with Hydraulic Front Attachment Kit or Loader to Logger Kit) (See Note 2) |
| 3 | 888 901 C1 | FRAME, w/two BUSHINGS 212 332 H1 front (Used on units equipped with Low Level Head Light Kit) (See Note 2) |
| 4 | 195 431 H1 | COVER, front access hole (2) |
| | 25 492 R1 | 5/16NC x 7/8" BOLT (6) |
| | 120 214 | 5/16" lock WASHER (6) |
| 5 | 215 978 H3 | SUPPORT, front hose |
| 6 | 221 712 H4 | SUPPORT, rear hose |
| | 181 435 | 1/2NF x 2" BOLT (2) |
| | 103 323 | 1/2" lock WASHER (2) |
| | 103 028 | 1/2"NF hex NUT (2) |
| 7 | 203 217 H1 | BAR, frame locking |
| | 203 372 H1 | PIN (2) |
| | 206 990 H1 | PIN, clinch |
| 8 | 196 500 H1 | PIN, draw bar (not used with counterweight Kit) |
| | 103 424 | PIN, cotter 1/4 x 2-1/4" |
| 9 | 887 683 C1 | COUNTERWEIGHT |
| | 25 998 R1 | 1 NF x 5-1/2" BOLT (4) Not used |
| | 25 550 R1 | 1" flat WASHER (4) ) with |
| | 25 531 R1 | 1" NC NUT (4) ) Counter- |
| | | ) weight Kit |
| 10 | 890 063 C2 | COUNTERWEIGHT, (2350 lbs.) Part of Counterweight Kit) |
| | 28 106 R1 | BOLT, 1 NC x 14" (4) |
| | 271 638 | BOLT, 3/4NF x 3" |
| | 25 531 R1 | NUT, 1 NC hex (4) |
| 10 | 933 769 C1 | COUNTERWEIGHT, 4350 lbs. (Part of Loader to Logger Kit) |
| | 27 266 R1 | BOLT (4) |

NOTE 1 - Order on Machine Order Form.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FRAME AND COUNTERWEIGHT - Continued** |
| 11 | 888 763 C1 | PLATE (Part of FRONT FRAME 888 779 C1) |
| 12 | 884 038 C1 | BOSS (Part of FRONT FRAME 888 779 C1) |
| 13 | 890 969 C1 | FRAME (Part of Push Plate Kit) |
| | 271 587 | 5/8NF x 2" BOLT (8) |
| | 103 325 | WASHER, 5/8" lock (8) |
| | 17 189 R1 | 1NF x 7" BOLT (4) |
| 14 | 194 486 H1 | EAR, right hand (2) |
| 15 | 932 050 C1 | BOSS, pinlock (4) |
| 16 | 932 051 C1 | BOSS, pinlock (3) |
| 17 | 932 052 C1 | BOSS, pinlock |
| 18 | 196 515 C1 | SHAFT |
| | | KIT, push plate (Order the following parts - 4 BOLT 17 189 R1; 8 BOLT 271 587; 1 FRAME 890 969 C1; 8 WASHER 103 325; 1 FRAME, rear rework 890 971 C1 ) |
| | 889 806 C91 | KIT, 2600 lb optional counterweight (See Note 1) (Consists of - 4 BOLT 28 106 R1; 1 BOLT 271 638; 1 COUNTER-WEIGHT 890 063 C2; 1 DRAWING FRAME FGH-11239 ) |

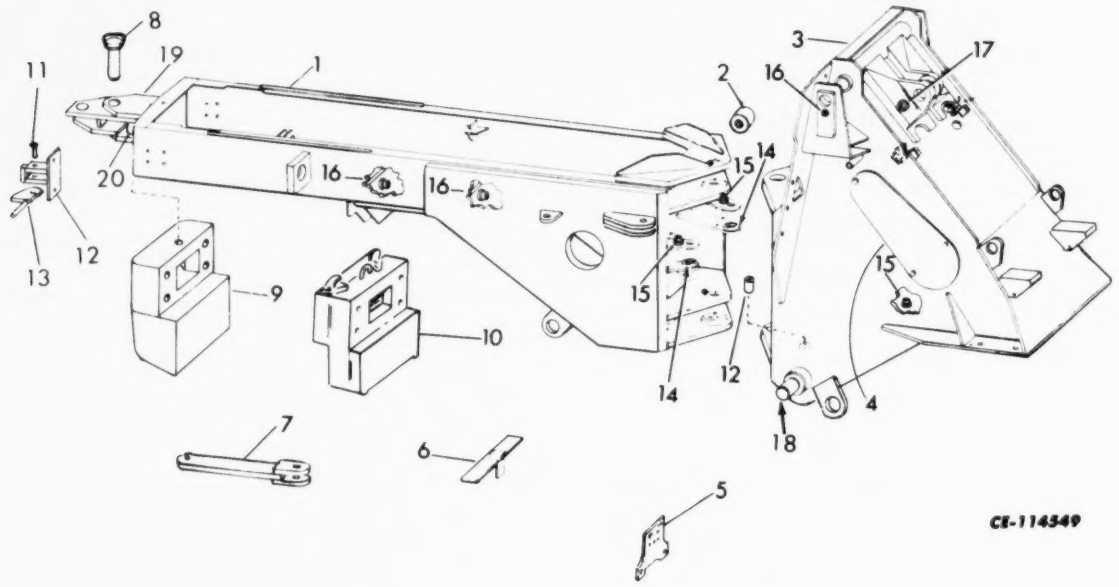
NOTE 1 - Order on Machine Order Form.

NOTE 2 - Service part will be available on special order with clearance of the Engineering Dept. Chassis serial number must be furnished when ordering. Order on Machine Order Form.

# FRAME

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

FRAME AND COUNTERWEIGHT
(Used on H-100C Military)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | M1 134 135 C1 | FRAME, rear (See Note 1) |
| | | (Consists of - |
| | | 4 BOSS 932 050 C1 |
| | | $ 1 FRAME |
| | | 2 EAR 194 486 H1 |
| | | 1 PLATE M1 134 132 C1 |
| | | 1 PIN M1 134 364 C1) |
| 2 | 216 294 H1 | BUMPER, steering (2) |
| | 181 434 | BOLT (2) |
| | 18 452 R1 | NUT (2) |
| | 103 343 | WASHER (2) |
| 3 | M1 134 400 C91 | FRAME, front (See Note 1) |
| | | 2 BUSHING 212 332 H1 |
| | | $ 1 FRAME |
| | | 3 BOSS 932 051 C1 |
| | | 1 BOSS 932 052 C1 |
| | | 1 SHAFT 196 515 C1) |
| 4 | 195 431 H1 | COVER, front access hole (2) |
| | 25 492 R1 | BOLT (6) |
| | 120 214 | WASHER, lock (6) |
| 5 | 215 978 H3 | SUPPORT, front hose |
| 6 | 221 712 H4 | SUPPORT, rear hose |
| | 181 435 | BOLT (2) |
| | 103 323 | WASHER (2) |
| | 103 028 | NUT (2) |
| 7 | 203 217 H1 | BAR, frame locking |
| | 203 372 H1 | PIN (2) |
| | 206 990 H1 | PIN, clinch |
| 8 | M1 234 129 C1 | PIN |
| 9 | 887 683 C1 | COUNTERWEIGHT |
| | 28 106 R1 | BOLT (4) |
| | 25 550 R1 | WASHER (4) |
| | 25 531 R1 | NUT (4) |
| 10 | 890 063 C2 | COUNTERWEIGHT (2350 lbs.) |
| 11 | 33 558 V | PIN |
| | 137 185 | PIN, cotter |
| 12 | M1 134 128 C1 | BAR |
| | 25 485 R1 | BOLT (2) |
| | 25 551 R1 | WASHER, flat (2) |
| 13 | 924 416 C1 | SUPPORT |
| 14 | 194 486 H1 | EAR, right hand (2) |
| 15 | 932 050 C1 | BOSS, pinlock (4) |
| 16 | 932 051 C1 | BOSS, pinlock (3) |
| 17 | 932 052 C1 | BOSS, pinlock |
| 18 | 196 515 C1 | SHAFT |
| 19 | M1 134 132 C1 | PLATE |
| 20 | M1 134 364 C1 | PIN |

NOTE 1- Service part will be available on special order with clearance of the Engineering Dept. Chassis serial number must be furnished when ordering. Order on Machine Order Form.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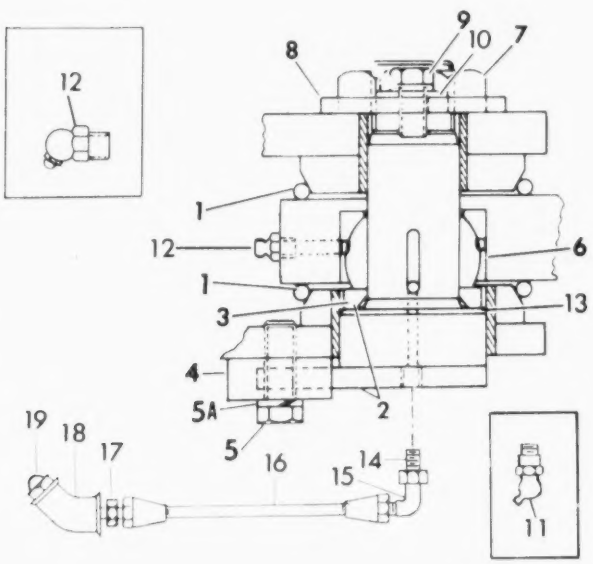
# FRAME

HINGE PIN

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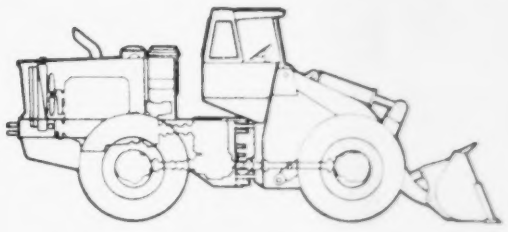
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 216 287 H1 | RING, cord (together with BOLT, 26 290 R1, two WASHER, 118 773 and NUT, 24 468 R1 will work for cord ring (solid) 218 132 R1) (4) |
| | 26 290 R1 | BOLT, 1/4NF x 4-1/2" (4) |
| | 118 773 | WASHER, 1/4" flat (8) |
| | 24 468 R1 | NUT, 1/4"NF Esna (4) |
| 2 | 876 444 C92 | SHAFT w/BUSHING, 876 445 C1, frame pivot (2) |
| 3 | 876 445 C1 | BUSHING (2) |
| 4 | 217 671 H2 | LOCKPLATE, cam (Used with 2" long bolt) (2) |
| 4 | 220 383 H2 | LOCKPLATE, cam (Used with 2-1/4" long bolt) (2) |
| 5 | 271 635 | BOLT, 3/4NF x 2-1/4" (Used with LOCKPLATE, 217 671 H2) (2) |
| 5 | 271 634 | BOLT, 3/4NF x 2" (Used with LOCKPLATE, 220 383 H2) (2) |
| 5A | 131 046 | WASHER, 3/4" lock (2) |
| 6 | 212 332 H1 | BUSHING, ball (2) |
| 7 | 211 149 H1 | NUT, special (2) |
| 8 | 211 055 H1 | PLATE, retainer (2) |
| 9 | 273 128 | BOLT, 1NF x 1-3/4" (2) |
| 10 | 121 326 | WASHER, 1" lock (2) |
| 11 | 117 176 | FITTING, grease (1/4" x 45°) (2) U00 * to * C00 * to * |
| 11 | 126 152 | FITTING, grease (1/8" x 45°) (2) U00 * to * C00 * to 1719 |
| 12 | 126 152 | FITTING, grease (1/8" x 45°) (2) U00 * and below C001719 and below |
| 12 | 109 461 | FITTING, grease (1/8" straight) (2) U00 * and up C001720 and up |
| 13 | 895 344 C1 | SHIM (x) |
| 14 | 443 999 | ADAPTER, pipe (2) C001720 and up U0 * and up |
| 15 | 9 402 862 | ELBOW, 90° tube (2) C001720 and up U0 * and up |
| 16 | 935 782 C1 | TUBE ASSEMBLY (2) C001720 and up U0 * and up |
| 17 | 9 402 706 | CONNECTOR (2) C001720 and up U0 * and up |
| 18 | 105 414 | ELBOW, 45° pipe (2) C001720 and up U0 * and up |
| 19 | 109 461 | FITTING, grease (1/8" straight) (2) C001720 and up U0 * and up |

(x) - As Required.

* - Serial Number Not Available.

# SECTION 10

# HYDRAULICS



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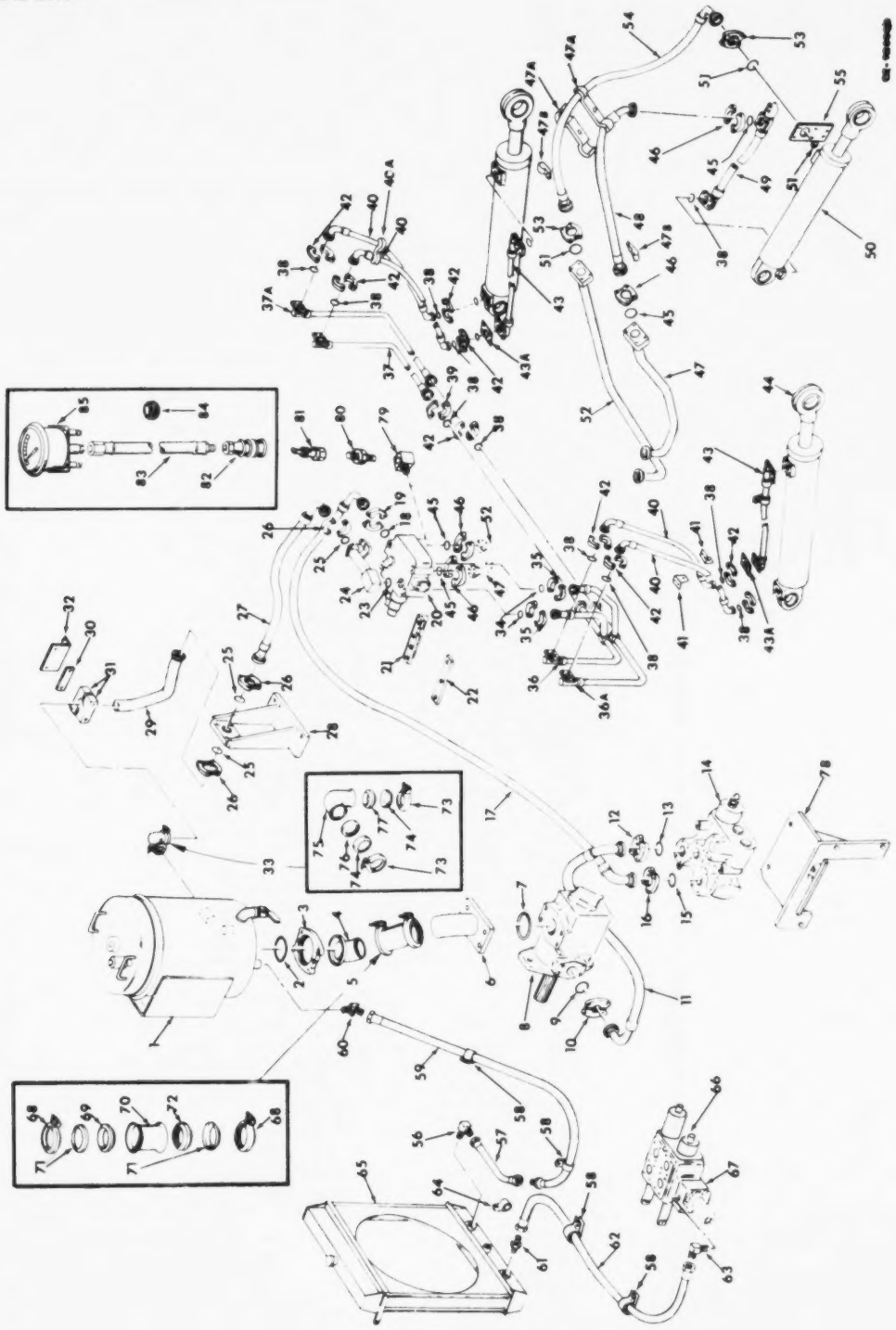
**BOOM AND BUCKET LINES**
**U001108 and below except 01097**
**C001126 and below**





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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BOOM AND BUCKET LINES - Continued** |
| | | **U001108 and below except 01097** |
| | | **C001126 and below** |
| 1 | | RESERVOIR (See Reservoir in this Section) |
| | 271 587 | 5/8NF x 2" BOLT (4) |
| | 18 453 R1 | 5/8 - 18 NF NUT (4) |
| 2 | 876 085 C1 | "O" RING |
| 3 | 198 455 H1 | CLAMP (2) |
| | 271 560 | 5/8NC x 1-1/2" BOLT (4) |
| 4 | 199 116 H1 | ELBOW |
| 5 | | COUPLING (Order component parts) |
| 6 | 884 121 C1 | ELBOW |
| | 271 562 | 5/8NC x 2" BOLT (4) |
| 7 | 876 083 C1 | "O" RING |
| 8 | | PUMP, main (See Main Pump in this Section) |
| | 271 565 | 5/8NC x 2-3/4" BOLT (2) |
| | 103 325 | 5/8" lock WASHER (2) |
| | | **SHAFT END-PUMP TO DEMAND VALVE** |
| 9 | 876 074 C1 | "O" RING |
| 10 | 301 844 R1 | FLANGE, split (2) |
| | 179 887 | 1/2NC x 1-3/4" BOLT (4) |
| 11 | 884 087 C1 | HOSE |
| 12 | 290 045 R1 | FLANGE, split (2) |
| | 70 427 R1 | 7/16NC x 1-1/4" BOLT (4) |
| 13 | 876 072 C1 | "O" RING |
| 14 | | VALVE, demand (See Demand Valve in this Section) |
| | 271 611 | 3/4NC x 2" BOLT (2) |
| | 271 612 | 3/4NC x 1-1/2 BOLT |
| | 103 326 | 3/4" lock WASHER (3) |
| | | **LINE-DEMAND VALVE TO LOADER VALVE** |
| 15 | 876 072 C1 | "O" RING |
| 16 | 290 045 R1 | FLANGE, split (2) |
| | 70 427 R1 | 7/16NC x 1-1/4" BOLT (4) |
| 17 | 884 114 C1 | HOSE |
| 18 | 876 074 C1 | "O" RING |
| 19 | 301 844 R1 | FLANGE, split (2) |
| | 179 887 | 1/2NC x 2" BOLT (4) |
| 20 | | VALVE, main control (See Main Control Valve in this Section) |
| | 185 338 H1 | BOLT, manifold block |
| | 273 031 | BOLT, manifold |
| | 273 034 | 3/4NF x 9" BOLT |
| | 18 558 R1 | 3/4 - 16NF Esna NUT (3) |
| 21 | 884 037 C1 | SUPPORT |
| | 271 634 | 3/4NF x 2" BOLT (4) |
| | 103 326 | 3/4" lock WASHER (4) |
| 22 | 884 082 C1 | BAR |
| | | **RETURN-LINE, LOADER VALVE TO RESERVOIR** |
| 23 | 876 075 C1 | "O" RING |
| 24 | 884 129 C2 | TUBE |
| 25 | 876 077 C1 | "O" RING (2) |
| 26 | 300 525 R1 | FLANGE, split (6) |
| | 24 863 R1 | 1/2NC x 1-3/4" BOLT (4) |
| | 181 443 | 1/2NC x 3-1/4" BOLT (4) |
| | 103 028 | 1/2" NF hex NUT (4) |
| 27 | 884 090 C2 | HOSE |
| 28 | 884 095 C1 | BRACKET |
| | 24 888 R1 | 3/4NC x 2" BOLT |
| | 25 548 R1 | 3/4" lock WASHER (2) |
| | 24 590 R1 | 3/4" x 2-1/2" BOLT |
| | 140 226 H1 | SPACER (2) |
| 29 | 884 098 C1 | TUBE |
| 30 | 209 335 H1 | PLATE |
| | 117 124 H1 | WASHER (3) |
| 31 | 209 331 H1 | CLAMP |
| | 186 309 | 3/8NC x 3-1/4" BOLT (2) |
| | 17 234 R1 | 3/8NF - 24NF Esna NUT (2) |
| 32 | 219 093 H1 | ANGLE |
| 33 | 196 091 H4 | ELBOW, 90° (Composed of - 2 COUPLING 180 707 H2; 1 SEAL 180 708 H2; 1 ELBOW 192 680 H1) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BOOM AND BUCKET LINES - Continued** |
| | | **U001108 and below except 01097** |
| | | **C001126 and below** |
| 33 | 196 091 H4 | ELBOW, 90° |
| | | (Composed of - Continued |
| | | 1 SEAL 877 202 C1 |
| | | 1 WASHER 877 203 C1) |
| | 181 427 | 1/2NF x 1" BOLT |
| | 103 323 | 1/2" lock WASHER |
| | 103 028 | 1/2NF hex NUT |
| | 106 265 | 1/2 flat WASHER |
| | | **LINE-VALVE TO BOOM CYLINDER** |
| 34 | 876 072 C1 | "O" RING (2) |
| 35 | 290 045 R1 | CLAMP (4) |
| | | 7/16NC x 1-1/4" BOLT (8) |
| 36 | 884 105 C1 | TUBE, boom lower |
| | 215 170 H1 | "U" BOLT (2) |
| | 9 413 980 | NUT, lock (4) |
| | 25 544 R1 | WASHER, flat (8) |
| 36A | 884 106 C2 | TUBE, boom raise |
| | 215 710 H1 | "U" BOLT (2) |
| | 9 413 980 | NUT, lock (4) |
| | 25 544 R1 | WASHER, flat (8) |
| 37 | 884 108 C1 | CROSSPIPE, boom lower |
| 37A | 884 107 C1 | TUBE |
| 38 | 876 071 C1 | "O" RING (10) |
| 39 | 877 949 C2 | CLAMP, split flange (4) |
| | 140 483 H | 3/8NC x 1-1/4" BOLT (8) |
| 40 | 893 199 C1 | HOSE (4) |
| 40A | 177 690 H1 | CLAMP (4) |
| | 181 436 | BOLT, 1/2NF x 2-1/4 (2) |
| | 106 265 | WASHER, 1/2 flat (2) |
| | 18 452 R1 | NUT, 1/2-20 hex (2) |
| 41 | 196 876 H1 | CLAMP (4) |
| | 181 436 | 1/2NF x 2-1/4" BOLT (4) |
| | 106 205 | 1/2 flat WASHER (4) |
| | 18 452 R1 | 1/2NF - 20 Esna NUT (4) |
| 42 | 877 949 C2 | CLAMP (16) |
| | 140 483 H | 3/8NC x 1-1/4" BOLT (32) |
| 43 | 184 033 H2 | TUBE (Not used on units equipped with Loader to Logger Kit) (2) |
| 43 | 920 422 C1 | TUBE (Used only on units equipped with Loader to Logger Kit) (2) |
| | 138 243 | 3/8 x 1/4" hex-hd cap SCREW (8) |
| 43A | 153 680 H1 | PLATE, adapter (2) |
| | 181 377 | 3/8NF x 1-3/4" BOLT (8) |
| | 120 382 | 3/8" lock WASHER (8) |
| | 103 026 | 3/8NF NUT (8) |
| 44 | | CYLINDER, boom (See Boom Cylinder in this Section) |
| | | **LINE-VALVE TO BUCKET CYLINDER** |
| 45 | 876 072 C1 | "O" RING, (4) |
| 46 | 290 045 R1 | CLAMP (8) |
| | 70 427 R1 | 7/16NC x 1-1/4" BOLT (16) |
| 47 | 884 109 C1 | TUBE, bucket |
| 47A | 892 647 C1 | CLAMP, (With 3/8" hole) (2) |
| | 181 370 | BOLT, 3/8NF x 1-1/4" |
| | 103 321 | WASHER, 3/8 lock |
| | 103 026 | NUT, 3/8 hex |
| 47B | 26 613 R1 | CLAMP, closed (1/2" Bolt hole) |
| | 24 861 R1 | BOLT, 1/2"NC x 1-1/4" |
| | 106 265 | WASHER, 1/2" flat |
| | 9 412 230 | NUT, 1/2" NC |
| 48 | 196 032 H2 | HOSE (Not used on 13' High Lift Boom Kit) |
| 48 | 891 854 C1 | HOSE (Used on 13' High Lift Boom Kit) |
| 49 | 887 712 C1 | TUBE (not used on 13' High Lift Boom Kit) |
| 49 | 891 856 C1 | TUBE (Used on 13' High Lift Boom Kit) |
| | 70 427 R1 | 7/16NC x 1-1/4" BOLT (4) |
| 50 | | CYLINDER, bucket (See Bucket Cylinder in this Section) |
| | | **LINE-VALVE TO CYLINDER BUCKET PUMP** |
| 51 | 876 072 C1 | "O" RING (4) |
| 52 | 884 110 C2 | TUBE, bucket close |
| | 176 159 H2 | "U" BOLT (3) |
| | 9 413 979 | NUT, lock (6) |
| | 25 544 R1 | WASHER, flat (12) |
| 53 | 290 045 R1 | CLAMP (4) |
| | 70 427 R1 | 7/16NC x 1-1/4" BOLT (4) |
| | 24 851 R1 | 7/16NC x 1-3/4" BOLT (4) |



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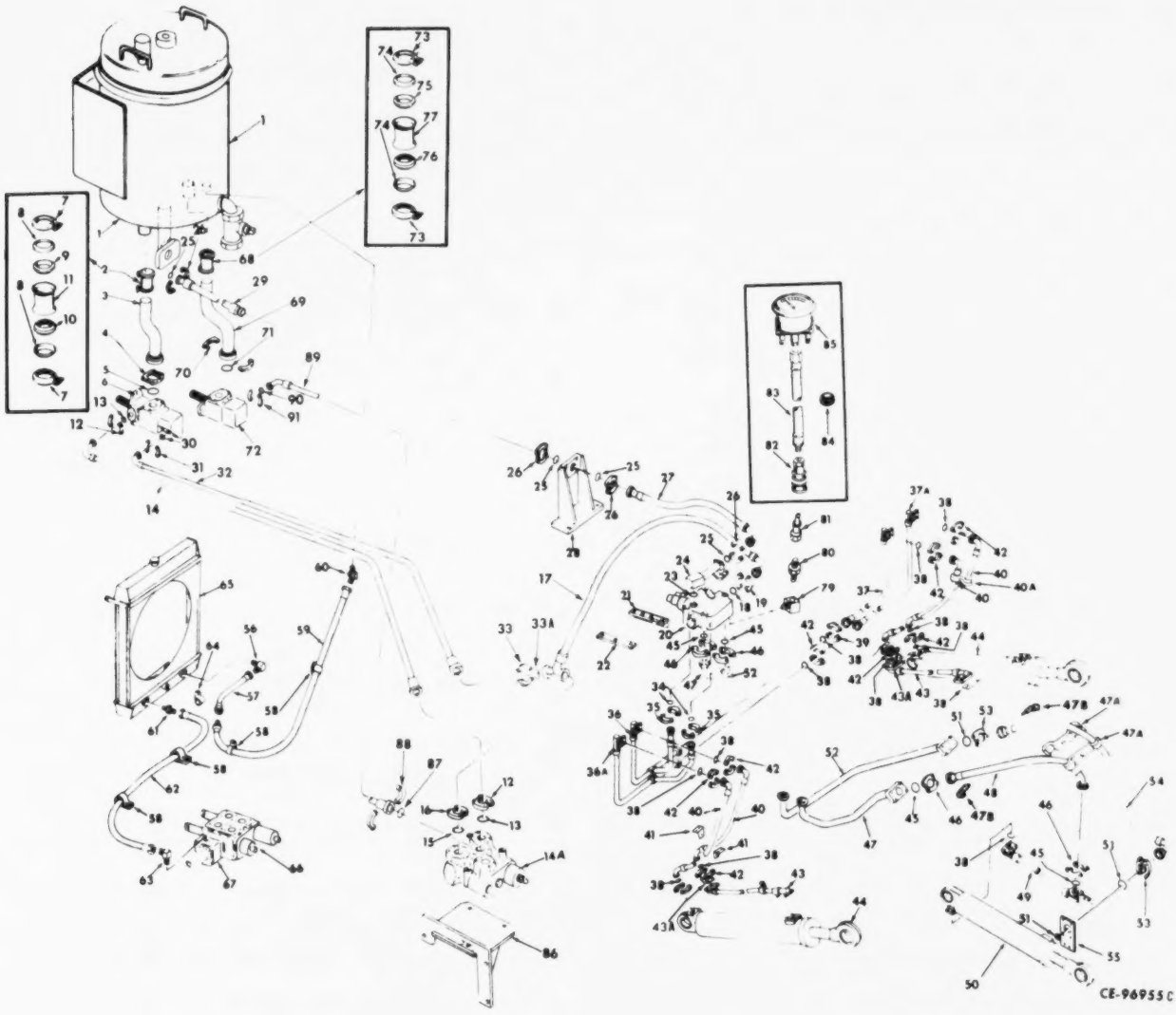
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BOOM AND BUCKET LINES - Continued** |
| | | **U001108 and below except 01097** |
| | | **C001126 and below** |
| 54 | 177 687 H2 | HOSE (Not used on 13' High Lift Boom Kit) |
| 54 | 891 855 C1 | HOSE (Used on 13' High Lift Boom Kit) |
| 55 | 194 219 H1 | PLATE |
| | 140 483 | BOLT (2) |
| | 25 553 R1 | WASHER, flat (4) |
| | 9 413 979 | NUT, lock (2) |
| | | **LINE-HYDRAULIC OIL COOLING** |
| 56 | 9 402 868 | CONNECTOR, at radiator |
| 57 | 884 162 C1 | HOSE |
| 58 | 3 049 881 R1 | CLAMP (4) |
| 59 | 884 153 C1 | HOSE |
| 60 | 9 402 829 | ELBOW, 45° |
| 61 | 9 402 712 | CONNECTOR |
| 62 | 884 154 C1 | HOSE |
| 63 | 9 402 829 | CONNECTOR, 45° |
| 64 | 134 054 H1 | CLAMP |
| | 181 361 | 3/8NF x 7/8" BOLT |
| | 120 382 | 3/8" lock WASHER |
| 65 | | RADIATOR (See Radiator in Section 6) |
| 66 | | VALVE, steering (See Steering Valve in Section 5) |
| 67 | | BLOCK (See Steering Lines in this Section) |
| | | **MISCELLANEOUS** |
| 68 | 204 149 H2 | COUPLING (2) |
| 69 | 204 150 H2 | SEAL |
| 70 | 204 151 H1 | SLEEVE |
| 71 | 877 230 C1 | RETAINER |
| 72 | 877 231 C1 | SEAL |
| 73 | 180 707 H3 | COUPLING (2) |
| 74 | 180 708 H3 | SEAL |
| 75 | 192 680 H1 | ELBOW |
| 76 | 877 202 C1 | SEAL |
| 77 | 877 203 C1 | WASHER |
| 78 | 884 077 C1 | FRAME |
| | 186 339 | 1/2NF x 5-1/4" BOLT (3) |
| | 18 452 R1 | 1/2NF x 20 Esna NUT (3) |
| | 140 226 H1 | SPACER (2) |
| | | **QUICK DISCONNECT** |
| 79 | 890 729 C1 | ELBOW 01034 and up except 01065 |
| 80 | 443 987 | NIPPLE 01034 and up except 01065 |
| 81 | 342 775 R91 | CAP, quick disconnect 01034 and up except 01065 |
| | | **LINE-VALVE TO GAUGE** |
| 82 | 891 300 C1 | FITTING, socket (used with Auxiliary Instruments) * |
| 83 | 891 298 C1 | HOSE (Used with Auxiliary Instruments)* |
| 84 | 145 705 H1 | GROMMET (used with Auxiliary Instruments)* |
| 85 | 891 326 C2 | GAUGE, hydraulic pressure (Used with Auxiliary Instruments)* |
| | 931 289 C1 | CABLE, bucket cylinder hose tie down (2) |
| | 25 485 R1 | BOLT, 1/4"NC x 1-1/4" (2) |
| | 26 110 R1 | NUT, 1/4" NC (2) |

* Also Listed and Illustrated in Section 11.

BOOM AND BUCKET LINES
U001109 and up except 01097
C001127 and up



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**BOOM AND BUCKET LINES - Continued**
**U001109 and up except 01097**
**C001127 and up**

**LINE-RESERVOIR TO MAIN PUMP**

| | | |
|---|---|---|
| 1 | | RESERVOIR (See Reservoir in this Section) |
| | 271 587 | 5/8NF x 2" BOLT (4) |
| | 18 453 R1 | 5/8-18NF NUT (4) |
| 2 | 178 264 H4 | COUPLING (Composed of - 2 COUPLING 180 710 H2; 1 SEAL ASSY. 180 711 H2; 1 SEAL ASSY. 877 242 C1; 1 SLEEVE 180 712 H1; 2 WASHER 877 241 C1 ) |
| 3 | 893 341 C1 | TUBE, suction |
| 4 | 336 064 R1 | FLANGE, split (2) |
| | 24 874 R1 | BOLT (4) |
| 5 | 876 080 C1 | "O" RING |
| 6 | | PUMP, main (See Main Pump in this Section) |
| | 271 565 | 5/8NC x 2-3/4" BOLT (2) |
| | 103 325 | 5/8" lock WASHER (2) |
| 7 | 180 710 H3 | COUPLING (2) |
| 8 | 877 241 C1 | WASHER (2) |
| 9 | 180 711 H3 | SEAL, assembly |
| 10 | 877 242 C1 | SEAL, assembly |
| 11 | 180 712 H2 | SLEEVE |

**LINE-MAIN PUMP TO DEMAND VALVE**

| | | |
|---|---|---|
| 12 | 290 045 R1 | FLANGE, split (4) |
| | 70 427 R1 | BOLT (8) |
| 13 | 876 072 C1 | "O" RING (2) |
| 14 | 893 345 C1 | HOSE |
| 14A | | VALVE, demand (See Demand Valve in this Section) |
| | 271 611 | 3/4NC x 2" BOLT (2) |
| | 271 612 | 3/4NC x 1-1/2 BOLT |
| | 103 326 | 3/4NC lock WASHER (3) |

**LINE - DEMAND VALVE TO LOADER VALVE**

| | | |
|---|---|---|
| 15 | 876 072 C1 | "O" RING |
| 16 | 290 045 R1 | FLANGE, split (2) |
| | 70 427 R1 | BOLT (4) |
| 17 | 893 344 C2 | HOSE |
| 18 | 876 074 C1 | "O" RING |
| 19 | 301 844 R1 | FLANGE, split (2) |
| | 24 862 R1 | 1/2NC x 1-1/2" BOLT (4) |
| 20 | | VALVE, main control (See Main Control Valve in this Section) |
| | 185 338 H1 | BOLT, manifold block |
| | 273 031 | BOLT, manifold |
| | 273 034 | 3/4NF x 9" BOLT |
| | 18 558 R1 | 3/4-16NF Esna NUT (3) |
| 21 | 884 037 C1 | SUPPORT |
| | 271 634 | 3/4NF x 2" BOLT (4) |
| | 103 326 | 3/4" lock WASHER (4) |
| 22 | 884 082 C2 | BAR |

**RETURN - LINE, LOADER VALVE TO RESERVOIR**

| | | |
|---|---|---|
| 23 | 876 075 C1 | "O" RING |
| 24 | 884 129 C2 | TUBE |
| 25 | 876 077 C1 | "O" RING (4) |
| 26 | 300 525 R1 | FLANGE, split (8) |
| | 24 863 R1 | 1/2NC x 2" BOLT (8) |
| | 181 443 | 1/2NC x 3-1/4" BOLT (4) |
| | 103 028 | 1/2NF hex NUT (4) |
| 27 | 884 090 C2 | HOSE |
| 28 | 884 095 C1 | BRACKET |
| | 24 888 R1 | 3/4NC x 2" BOLT |
| | 25 548 R1 | 3/4" lock WASHER (2) |
| | 24 890 R1 | 3/4" x 2-1/2" BOLT |
| | 140 226 H1 | SPACER (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BOOM AND BUCKET LINES - Continued** |
| | | **U001109 and up except 01097** |
| | | **C001127 and up** |
| 29 | 893 342 C3 | HOSE |
| 30 | 876 071 C1 | "O" RING |
| 31 | 877 949 C2 | FLANGE, split (2) |
| | 140 483 | 3/8NC x 1-1/4 BOLT (4) |
| 32 | 893 346 C1 | HOSE |
| 33 | 290 045 R1 | FLANGE, split (2) |
| | 70 427 R1 | BOLT (4) |
| 33A | 876 072 C1 | "O" RING |
| | | **LINE - VALVE TO BOOM CYLINDER** |
| 34 | 876 072 C1 | "O" RING (2) |
| 35 | 290 045 R1 | FLANGE, split (4) |
| | 70 427 R1 | BOLT (8) |
| 36 | 884 105 C1 | TUBE, boom lower |
| | 215 710 H1 | "U" BOLT (2) |
| | 9 413 980 | NUT, lock (4) |
| | 25 544 R1 | WASHER, flat (8) |
| 36A | 884 106 C2 | TUBE, boom raise |
| | 215 710 H1 | "U" BOLT (2) |
| | 9 413 980 | NUT, lock (4) |
| | 25 544 R1 | WASHER, flat (8) |
| 37 | 884 108 C1 | CROSSPIPE, boom lower |
| 37A | 884 107 C1 | TUBE |
| 38 | 876 071 C1 | "O" RING (10) |
| 39 | 877 949 C2 | CLAMP, split flange (4) |
| | 140 483 H | BOLT (8) |
| 40 | 893 199 C1 | HOSE (2) |
| 40A | 177 690 H1 | CLAMP (4) |
| | 181 436 | 1/2NF x 2-1/4" BOLT (2) |
| | 106 265 | 1/2" flat WASHER (2) |
| | 18 452 R1 | 1/2-20 hex NUT (2) |
| 41 | 196 876 H1 | CLAMP (4) |
| | 181 436 | 1/2NF x 2-1/4" BOLT (4) |
| | 106 205 | 1/2 flat WASHER (4) |
| | 18 452 R1 | 1/2NF - 20 Esna NUT (4) |
| 42 | 877 949 C2 | CLAMP (16) |
| | 140 483 H | BOLT (32) |
| 43 | 184 033 H2 | TUBE, (Not used on units equipped with Loader to Logger Kit) (2) |
| 43 | 920 422 C1 | TUBE, (Used only on units equipped with Loader to Logger Kit) (2) |
| | 138 243 | 3/8 x 1/4" hex-hd cap SCREW (8) |
| 43A | 153 680 H1 | PLATE, connector (2) |
| | 103 026 | NUT (8) |
| | 181 377 | SCREW, hex-hd cap (8) |
| | 120 382 | WASHER, lock (8) |
| 44 | | CYLINDER, boom (See Boom Cylinder in this Section) |
| | | **LINE - VALVE TO BUCKET CYLINDER** |
| 45 | 876 072 C1 | "O" RING (4) |
| 46 | 290 045 R1 | CLAMP (8) |
| | 70 427 R1 | 7/16NC x 1-1/4" BOLT (16) |
| 47 | 884 109 C1 | TUBE, bucket |
| 47A | 892 647 C1 | CLAMP (With 3/8" Bolt hole) |
| | 181 370 | 3/8NF x 1-1/4" BOLT |
| | 103 321 | 3/8" lock WASHER |
| | 103 026 | 3/8" hex NUT |
| 47B | 26 613 R1 | CLAMP, closed (1/2" Bolt hole) (2) |
| | 24 861 R1 | BOLT (2) |
| | 106 265 | WASHER, flat (6) |
| | 9 412 230 | NUT (2) |
| 48 | 196 032 H2 | HOSE (Not used on 13' High Lift Boom Kit) |
| 48 | 891 854 C1 | HOSE (Used on 13' High Lift Boom Kit) |
| 49 | 893 004 C1 | TUBE (Not used on 13' High Lift Boom Kit) |
| | 891 856 C1 | TUBE (Used on 13' High Lift Boom Kit) |
| | 138 268 | BOLT (4) |
| 50 | | CYLINDER, bucket (See Bucket Cylinder in this Section) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BOOM AND BUCKET LINES - Continued** |
| | | **U001109 and up except 01097** |
| | | **C001127 and up** |
| | | **LINE - VALVE TO CYLINDER BUCKET PUMP** |
| 51 | 876 072 C1 | "O" RING (4) |
| 52 | 884 110 C2 | TUBE, bucket close |
| | 176 159 H2 | "U" BOLT (3) |
| | 9 413 979 | NUT, lock (6) |
| | 25 544 R1 | WASHER, flat (12) |
| 53 | 290 045 R1 | CLAMP (4) |
| | 70 427 R1 | 7/16NC x 1-1/4" BOLT (4) |
| | 24 851 R1 | 7/16NC x 1-3/4" BOLT (4) |
| 54 | 177 687 H | HOSE (Not used on 13' High Lift Boom Kit) |
| 54 | 891 855 C1 | HOSE (Used on 13' High Lift Boom Kit) |
| 55 | 194 219 H1 | PLATE U001374 and below C0* and below |
| | 181 314 | 1/4NF x 7/8" BOLT (2) |
| | 103 319 | 1/4" lock WASHER (2) |
| | 103 024 | 1/4NF hex NUT (2) |
| 55 | 194 219 H1 | PLATE U001375 and up C0* and up |
| | 9 413 979 | NUT, lock (2) |
| | 140 483 H | SCREW, hex-hd cap (2) |
| | 25 553 R1 | WASHER, flat (4) |
| | | **LINE - HYDRAULIC OIL COOLING** |
| 56 | 9 402 868 | CONNECTOR, at radiator |
| 57 | 884 162 C1 | HOSE |
| 58 | 3 049 881 R1 | CLAMP (4) |
| 59 | 884 153 C1 | HOSE |
| 60 | 9 402 829 | ELBOW, 45° |
| 61 | 9 402 712 | CONNECTOR |
| 62 | 884 154 C1 | HOSE |
| 63 | 9 402 829 | CONNECTOR, 45° |
| 64 | 134 054 H1 | CLAMP |
| | 181 361 | 3/8NF x 7/8" BOLT |
| | 120 382 | 3/8" lock WASHER |
| 65 | | RADIATOR (See Radiator in Section 6) |
| 66 | | VALVE, steering (See Steering Valve in Section 5) |
| 67 | | BLOCK (See Steering Lines in this Section) |
| | | **SUCTION - LINE TO STEERING PUMP** |
| 68 | 177 665 H4 | COUPLING (Composed of - 2 COUPLING 180 707 H2; 1 SEAL ASSY. 180 708 H2; 1 SEAL ASSY. 877 202 C1; 1 SLEEVE 180 709 H1; 2 WASHER 877 203 C1 ) |
| 69 | 893 340 C1 | TUBE, suction |
| 70 | 300 525 R1 | FLANGE, split (2) |
| | 24 862 R1 | 1/2NC x 1-1/2" BOLT (4) |
| 71 | 876 077 C1 | "O" RING |
| 72 | | PUMP, steering pump (See Steering Pump in this Section) |
| 73 | 180 707 H3 | COUPLING (2) |
| 74 | 877 203 C1 | WASHER (2) |
| 75 | 180 708 H3 | SEAL, assembly |
| 76 | 877 202 C1 | SEAL, assembly |
| 77 | 180 709 H2 | SLEEVE |
| | | **QUICK DISCONNECT** |
| 79 | 890 729 C1 | ELBOW |
| 80 | 443 987 | NIPPLE |
| 81 | 342 775 R91 | CAP, disconnect |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**BOOM AND BUCKET LINES - Continued**
**U001109 and up except 01097**
**C001127 and up**

### LINE - VALVE TO GAUGE

| | | |
|---|---|---|
| 82 | 891 300 C1 | FITTING, socket (Used with Auxiliary Instruments) (#) |
| 83 | 891 298 C1 | HOSE (Used with Auxiliary Instruments) (#) |
| 84 | 145 705 H1 | GROMMET (Used with Auxiliary Instruments) (#) |
| 85 | 891 326 C1 | GAUGE, hydraulic pressure (Used with Auxiliary Instruments) (#) |

### STEERING PUMP TO DEMAND VALVE

| | | |
|---|---|---|
| 86 | 884 077 C1 | FRAME |
| | 186 339 | 1/2 NF x 5-1/4" BOLT (3) |
| | 18 452 R1 | 1/2 NF x 20 Esna NUT (3) |
| | 140 226 H1 | SPACER (2) |
| 87 | | "O" RING (See Steering Lines in this Section) |
| 88 | | FLANGE, split (See Steering Lines in this Section) (2) |
| 89 | | HOSE (See Steering Lines in this Section) |
| 90 | | "O" RING (See Steering Lines in this Section) |
| 91 | | FLANGE, split (See Steering Lines in this Section) (2) |
| | 931 289 C1 | CABLE, bucket cylinder hose tie down (2) |
| | 140 483 H | BOLT, 3/8NC x 1-1/4" (2) |
| | 25 522 R1 | NUT, 3/8"NC (2) |
| | 25 553 R1 | WASHER, 3/8" lock (4) |
| | 935 464 C1 | STRAP (4) |

(#) - Also listed and illustrated in Section 11.

(*) - Serial Number Not Available.



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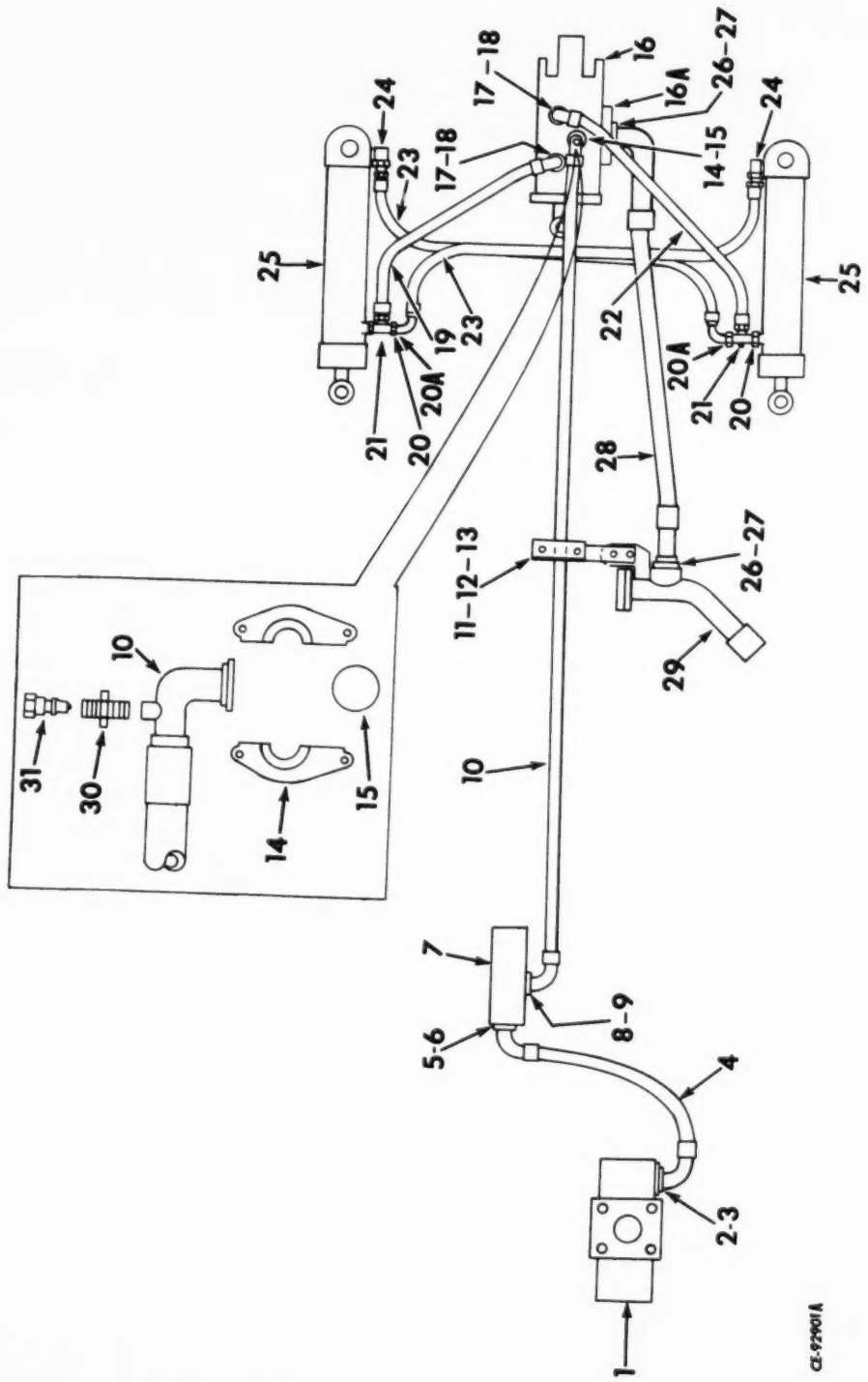
MEMORANDA

STEERING LINES



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

STEERING LINES - Continued

LINE - STEERING PUMP TO DEMAND VALVE

| | | |
|---|---|---|
| 1 | | PUMP, main hydraulic (See Main Hydraulic Pump in this Section)<br>U001108 and below except 1097<br>C001126 and below |
| 1 | | PUMP, steering (See Steering Pump in this Section)<br>U001109 and up also 01097<br>C001127 and up |
| 2 | 876 072 C1 | "O" RING |
| 3 | 290 045 R1<br>70 427 R1 | FLANGE, split (2)<br>BOLT (4) |
| 4 | 884 088 C1 | HOSE<br>U001108 and below except 01097<br>C001126 and below |
| 4 | 893 343 C1 | HOSE<br>U001109 and up also 01097<br>C001127 and up |
| 5 | 300 525 R1<br>24 862 R1 | FLANGE, split (2)<br>BOLT (4) |
| 6 | 876 077 C1 | "O" RING |
| 7 | | VALVE, demand (See Demand Valve in this Section) |

LINE - DEMAND VALVE TO STEERING VALVE

| | | |
|---|---|---|
| 8 | 876 072 C1 | "O'' RING |
| 9 | 290 045 R1<br>70 427 R1 | FLANGE, split (2)<br>SCREW, hex-hd cap (4) |
| 10 | 884 092 C2 | HOSE (together with NIPPLE 22 308 R1 and PLUG, 342 775 R91 will work for HOSE, 884 092 C1) |
| 11 | 884 127 C1<br>271 634<br>18 558 R1 | BRACKET<br>BOLT, hex-hd cap<br>NUT, Esna |
| 12 | 209 331 H1 | CLAMP (2) |
| 13 | 209 335 H1<br>186 312<br>17 234 R1 | PLATE<br>3/8NF x 4" BOLT (2)<br>3/8"NF Esna NUT (2) |
| 14 | 877 949 C2<br>101 896 R1 | FLANGE, half (2)<br>BOLT (4) |
| 15 | 876 071 C1 | "O" RING |
| 16 | | VALVE, steering (See Steering Valve in this Section) |
| 16A | 883 212 C1 | BLOCK, manifold |

LINE-STEERING VALVE TO STEERING CYLINDER

| | | |
|---|---|---|
| 17 | 876 071 C1 | "O" RING (2) |
| 18 | 877 949 C2<br>101 896 R1 | FLANGE, half (4)<br>BOLT (8) |
| 19 | 884 089 C1 | HOSE |
| 20 | 884 128 C1 | TEE, service (2) |
| 20A | 876 108 C1 | "O" RING (4) |
| 21 | 445 684 | PLUG, 1/8" pipe (2) |
| 22 | 884 091 C1 | HOSE |

LINE - STEERING VALVE TO LOADER VALVE RETURN

| | | |
|---|---|---|
| 23 | 883 454 C1 | HOSE, cylinder to cylinder (2) |
| 24 | 9 410 979 | ELBOW, 90° (2) |
| 25 | | CYLINDER, steering (See Steering Cylinder in this Section) (2) |
| 26 | 876 072 C1 | "O" RING (3) |
| 27 | 290 045 R1<br>24 854 R1<br>70 427 R1 | FLANGE, split (4)<br>7/16"NC x 3" BOLT (4)<br>7/16"NC x 1-1/4" BOLT (4) |
| 28 | 884 093 C1 | HOSE |
| 29 | | TUBE, manifold (See Boom and Bucket Lines in this Section) |

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

**STEERING LINES - Continued**

**QUICK DISCONNECT**

| | | |
|---|---|---|
| 30 | 22 308 R1 | NIPPLE |
| 31 | 342 775 R91 | CAP, quick disconnect |
| | 105 422 | ELBOW, 90° street (Quick connective) |



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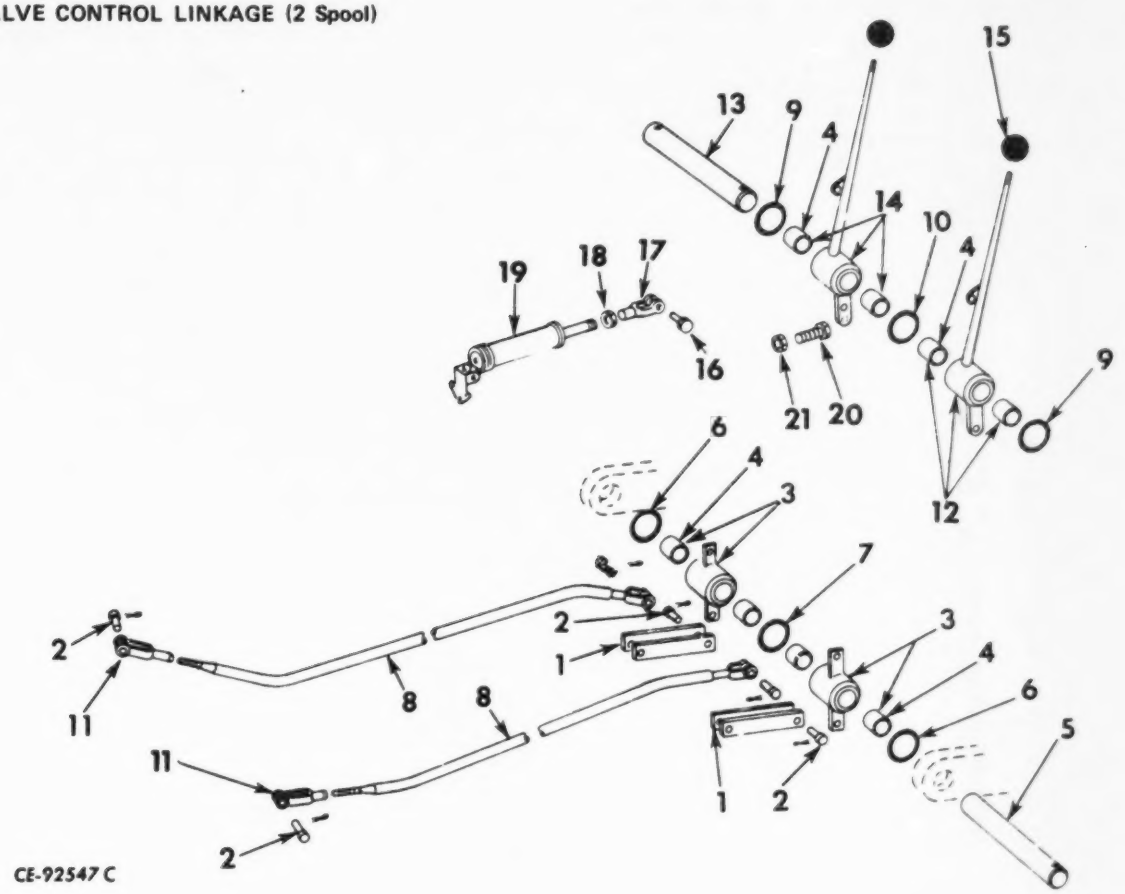
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

VALVE CONTROL LINKAGE (2 Spool)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 884 030 C1 | BAR, clevis (4) |
| 2 | 114 787 | CLEVIS (8) |
| | 103 374 | PIN, cotter (8) |
| 3 | 884 085 C11 | LEVER w/two BUSHING 144 243 H1 (2) |
| 4 | 144 243 H1 | BUSHING (8) |
| | 884 116 C1 | PIN |
| | 120 380 | 1/4" lock WASHER |
| | 181 324 | 1/4NF x 2-1/4" BOLT |
| | 103 024 | 1/4" hex NUT |
| 6 | 293 739 R1 | "O" RING (Replaces 164 513 R1) (2) |
| 7 | 293 739 R1 | "O" RING (Replaces 310 930 R1) |
| 8 | 884 062 C2 | ROD, control (2) |
| 9 | 293 739 R1 | "O" RING (3) |
| 10 | | NOT USED |
| 11 | 177 219 H1 | CLEVIS (2) |
| 12 | 884 074 C21 | LEVER w/two BUSHING, 144 243 H1, boom control (Not used on units equipped with Roll-Over Protective Structure) |
| 12 | 929 203 C91 | LEVER w/two BUSHING, 144 243 H1, boom control (Used only on units equipped with Roll-Over Protective Structure) |
| 13 | 884 116 C1 | PIN |
| | 181 326 | 1/4NF x 2-3/4" BOLT |
| | 120 380 | 1/4" lock WASHER |
| | 103 024 | 1/4NF hex NUT |
| 14 | 884 075 C21 | LEVER w/two BUSHING, 144 243 H1, bucket control (Not used on units equipped with Roll-Over Protective Structure |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | VALVE CONTROL LINKAGE (2 Spool) - Continued |
| 14 | 929 205 C91 | LEVER w/two BUSHING, 144 243 H1, bucket control (Used only on units equipped with Roll-Over Protective Structure) |
| 15 | HL-3343 | BALL (2) |
| 16 | 114 785 | PIN<br>U001156 and up<br>C001196 and up |
| 17 | 144 243 | YOKE<br>U001156 and up<br>C001196 and up |
| 18 | 114 494 | NUT, 3/8NF jam<br>U001156 and up<br>C001196 and up |
| 19 | 896 206 C1 | CYLINDER, air<br>U001156 and up<br>C001196 and up |
| | 153 138 | SCREW, No. 8 NC x 1/2" Machine (3) |
| | 453 996 | NUT, No. 8NC (3) |
| 20 | 181 376 | BOLT, 3/8NF x 1-5/8"<br>U001202 and up<br>C001210 and up |
| 21 | 114 494 | NUT, 3/8NF Jam<br>U001202 and up<br>C001210 and up |



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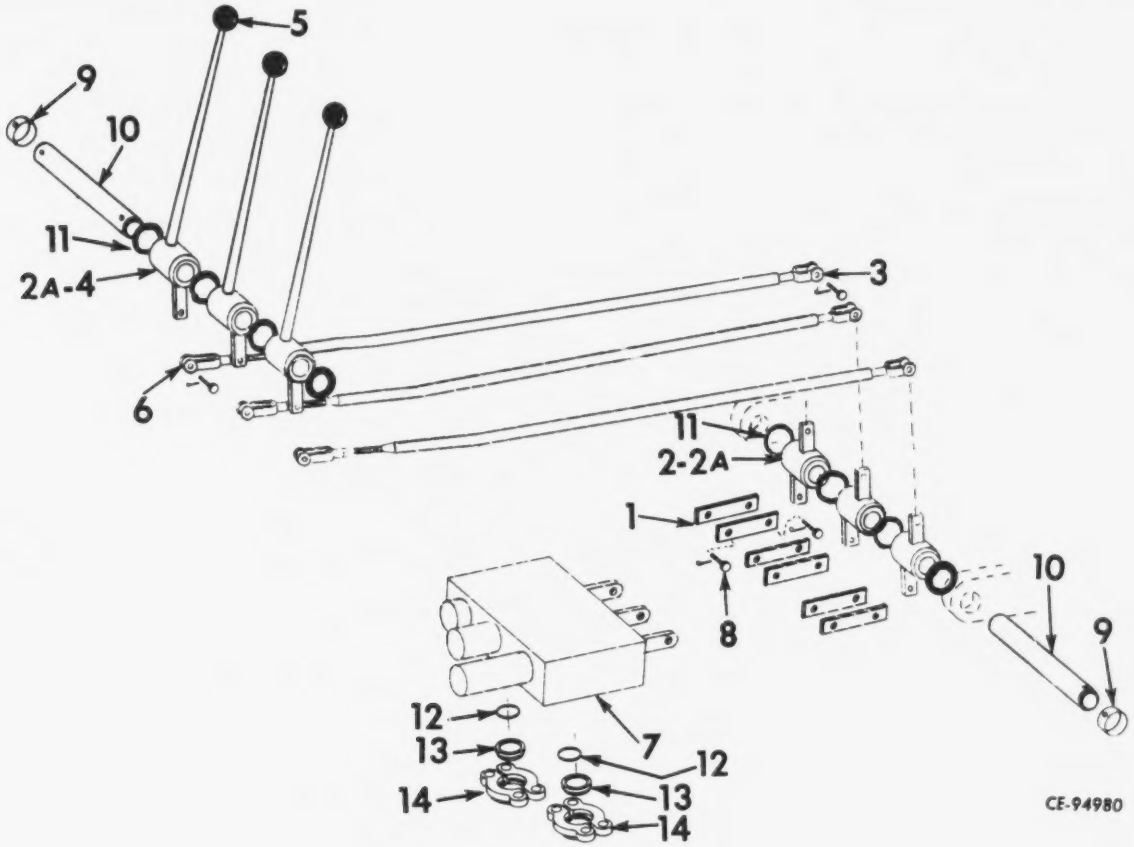
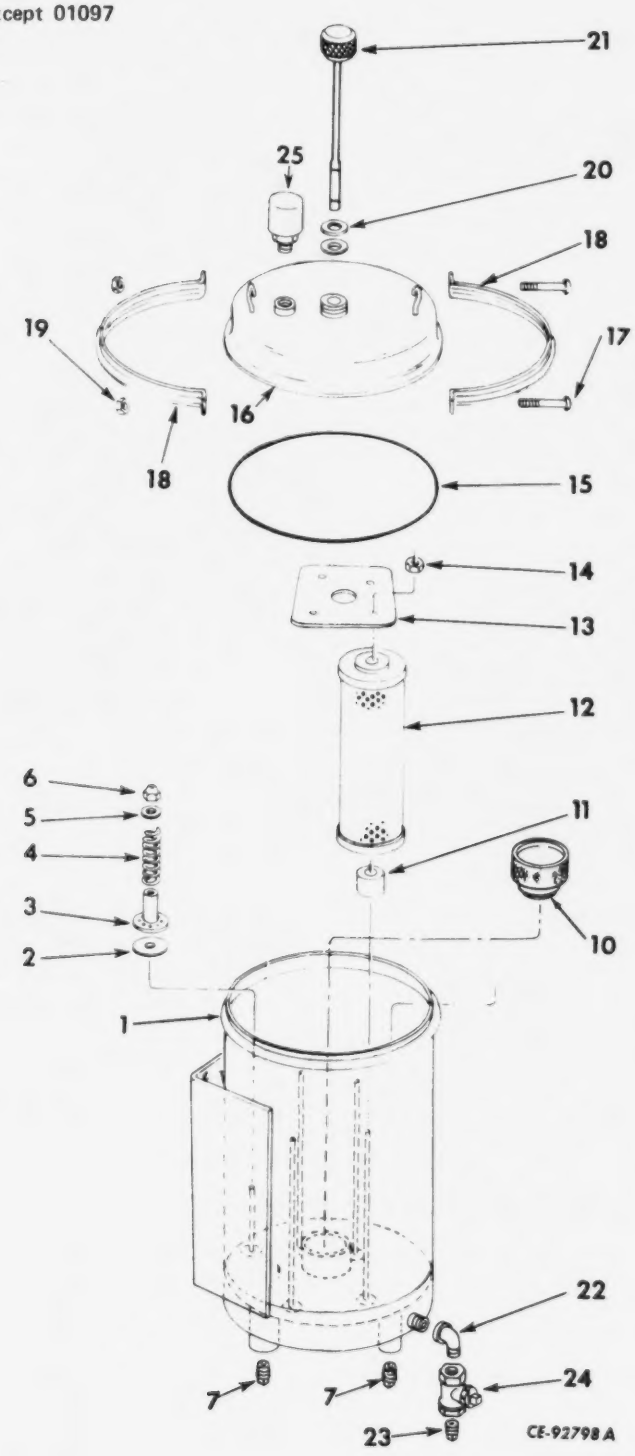
THREE-SPOOL VALVE CONTROL KIT




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 888 760 C91 | KIT, three spool valve (Consists of - |
| 1 | 884 030 C1 | BAR (2) |
| 2 | 888 766 C91 | LEVER w/two BUSHING 144 243 H1 |
| 2A | 144 243 H1 | BUSHING (4) |
| 3 | 884 062 C1 | ROD, clevis |
| 4 | 888 768 C91 | LEVER w/two BUSHING 144 243 H1 |
| 5 | HL-3343 | KNOB |
| 6 | 177 219 H1 | CLEVIS |
| 7 | | VALVE (See Three Spool Valve in this Section) |
| 8 | 114 787 | PIN (4) |
| 9 | 133 344 C1 | COLLAR (2) |
| | 181 326 | BOLT, 1/4NF x 2-3/4 (2) |
| | 103 319 | WASHER, 1/4" lock (2) |
| | 103 024 | NUT, 1/4NF hex (2) |
| | 92 778 R1 | WASHER |
| 10 | 888 771 C1 | PIN (2) |
| 11 | 293 739 R1 | "O" RING (2) |
| 12 | 876 072 C1 | "O" RING (2) |
| 13 | 656 658 C1 | FLANGE, blind (2) |
| 14 | 290 045 R1 | FLANGE, split (4) |
| | 179 860 | BOLT, 7/16NC x 1-1/4" (8) |
| | 103 322 | WASHER, 7/16 lock (8) |
| | 109 454 | GREASE, fitting (into lever) |
| | 876 072 C1 | "O" RING (Cylinder Valve Parts) (4) |
| | 876 075 C1 | "O" RING (at manifold) |
| | 876 074 C1 | "O" RING (from Demand Valve to Loader Valve) |
| | FGH-11091 | DRAWING, installation |

RESERVOIR
U001108 and below except 01097
C001126 and below



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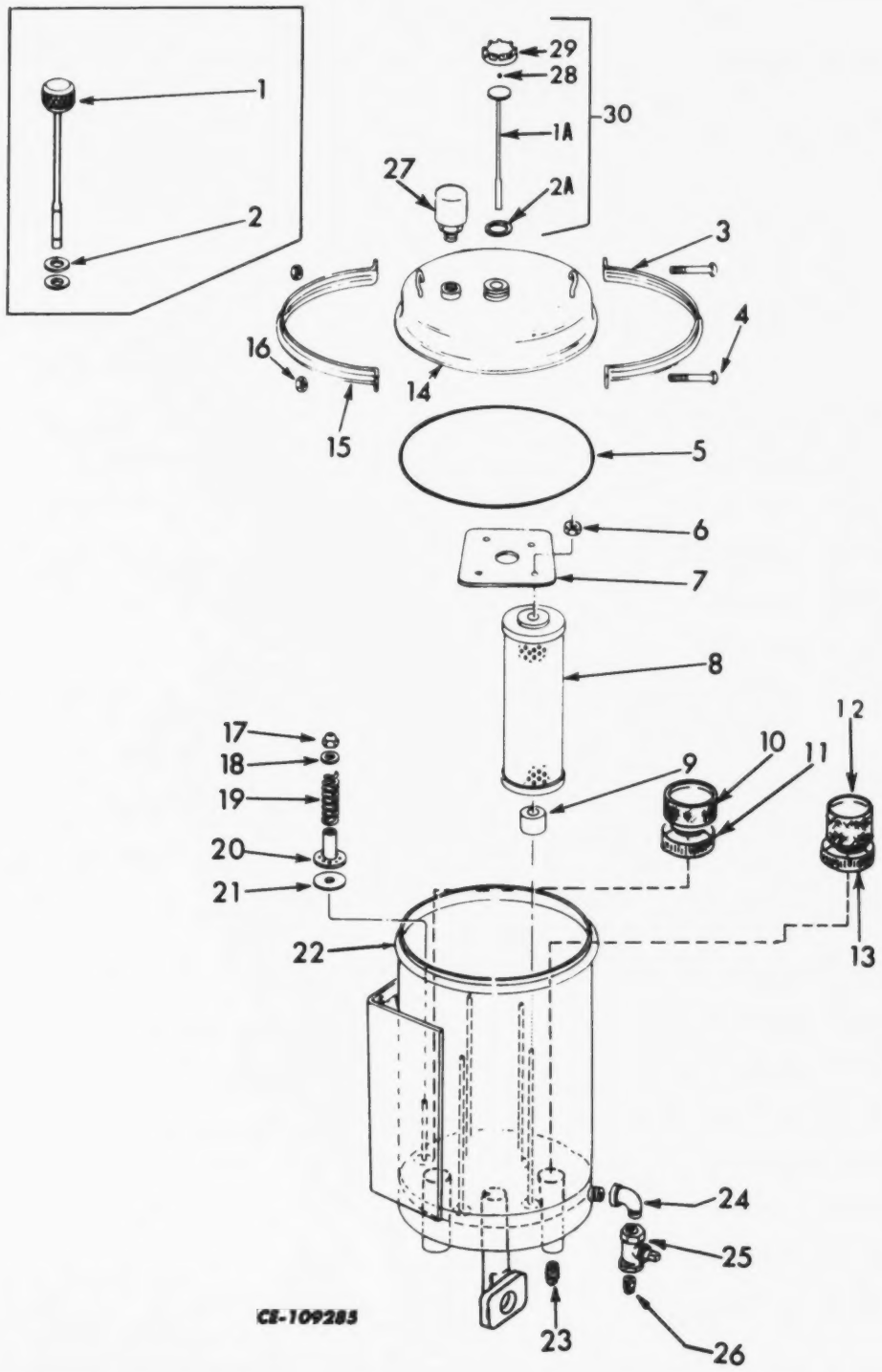
**RESERVOIR - Continued**
**U001108 and below except 01097**
**C001126 and below**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 883 725 C91 | RESERVOIR (Consists of items 1 thru 21) |
| 1 | 883 727 C1 | RESERVOIR |
| 2 | 877 825 C2 | INSULATOR |
| 3 | 877 811 C1 | SLEEVE |
| 4 | 176 026 H1 | SPRING |
| 5 | 106 263 | WASHER, 3/8" lock |
| 6 | 882 216 C1 | NUT, plunger |
| 7 | 20 969 R1 | PLUG, pipe (2) |
| 10 | 194 552 H2 | SCREEN |
| 11 | 877 824 C1 | SPACER (4) |
| 12 | 877 826 C4 | FILTER (4) |
| 13 | 885 188 C1 | RETAINER |
| 14 | 883 553 C1 | NUT (4) |
| 15 | 894 667 C1 | "O" RING (Together with two BOLTS, 892 692 C1 will work for "O" RING, 176 266 H1) |
| 16 | 883 075 C1 | HEAD |
| 17 | 879 375 C1 | BOLT, 3/8" x 2 (Used with "O" RING, 176 266 H1) (2) |
| 17 | 892 692 C1 | BOLT, 3/8 x 3" (Used with "O" RING, 894 667 C1) (2) |
| 16 | 883 075 C1 | HEAD |
| 17 | 892 692 C1 | BOLT (2) |
| 18 | 879 204 C1 | CLAMP (2) |
| 19 | 120 377 | NUT, 3/8" NC hex (2) |
| 20 | 134 045 H1 | SEAL (2) |
| 21 | 158 894 H1 | DIPSTICK |
| 22 | 141 621 | ELBOW, 90° |
| 23 | 20 969 R1 | PLUG, pipe |
| 24 | 891 495 C1 | VALVE, drain (Columbia pipe No. 9704) (Will work for DRAIN VALVE 215 605 H1) |
| 25 | | VALVE, relief (for components see Relief Valve in this Section) |

**RESERVOIR**
**U001109 and up also 01097**
**C001127 and up**



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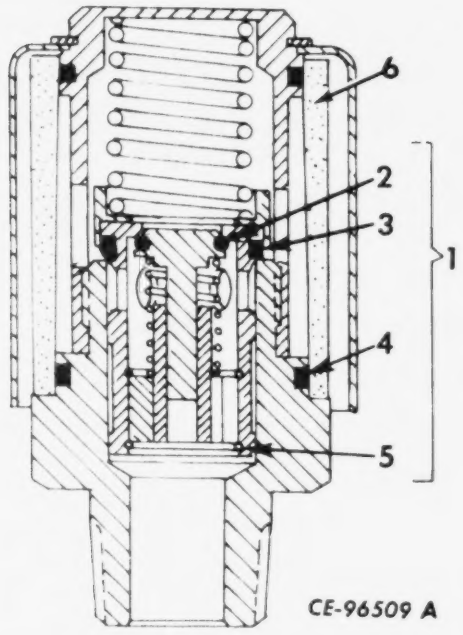
**RESERVOIR - Continued**
**U001109 and up also 01097**
**C001127 and up**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 893 311 C91 | RESERVOIR ASSEMBLY, hydraulic (Order RESERVOIR ASSEMBLY, 893 311 C92) |
| | 18 453 R1 | NUT (4) |
| | 271 587 | SCREW, hex-hd cap (4) |
| | 893 311 C92 | RESERVOIR ASSEMBLY, hydraulic |
| | 18 453 R1 | NUT (4) |
| | 271 587 | SCREW, hex-hd cap (4) (Consists of the following parts, except reference numbers, 23 thru 27 - |
| 1 | 878 705 C1 | GAUGE (Used w/HEAD, 883 075 C1) |
| 1A | 933 813 C1 | GAUGE (Used w/HEAD, 883 075 C2) |
| 2 | 134 045 H1 | SEAL, dipstick (Used w/HEAD, 883 075 C1) |
| 2A | 618 688 C1 | GASKET (Used w/HEAD, 883 075 C2) |
| 3 | 879 204 C1 | CLAMP |
| 4 | 879 375 C1 | BOLT, 3/8" x 3" (Used with "O" RING, 176 266 H1) (2) |
| 4 | 892 692 C1 | BOLT, 3/8" x 2" (Used with "O" RING, 894 667 C1) (2) |
| 5 | 894 667 C1 | "O" RING, (Together with two BOLTS, 892 692 C1 will work for "O" RING, 176 266 H1) |
| 5 | 894 667 C1 | "O" RING |
| 6 | 883 553 C1 | NUT (4) |
| 7 | 885 153 C1 | RETAINER |
| 8 | 877 826 C4 | FILTER (4) |
| 9 | 877 824 C1 | SPACER (4) |
| 10 | 878 670 C1 | SCREEN |
| 11 | 122 322 R91 | CLAMP |
| 12 | 878 673 C1 | SCREEN |
| 13 | 279 027 R91 | CLAMP |
| 14 | 883 075 C1 | HEAD (Used w/RESERVOIR ASSEMBLY, 893 311 C91) (Order HEAD, 883 075 C2 and CAP ASSEMBLY, 933 816 C91) |
| 14 | 883 075 C2 | HEAD (Used w/RESERVOIR ASSEMBLY , 893 311 C92) |
| 15 | 879 204 C1 | CLAMP |
| 16 | 120 377 | NUT, 3/8" NC hex (2) |
| 17 | 882 216 C1 | NUT, plunger |
| 18 | 106 263 | WASHER, 3/8" lock |
| 19 | 176 026 H1 | SPRING |
| 20 | 877 811 C1 | SLEEVE |
| 21 | 877 825 C2 | INSULATOR |
| 22 | 883 077 C1 | BODY |
| 23 | 20 969 R1 | PLUG, pipe |
| 24 | 141 621 | ELBOW, 90° |
| 25 | 891 495 C1 | VALVE, drain |
| 26 | 20 969 R1 | PLUG, pipe |
| 27 | | VALVE ASSY, vacuum pressure relief (See Relief Valve in this Section) |
| 28 | D-26 15 | BALL (Used w/HEAD, 883 075 C2) |
| 29 | 618 690 C2 | CAP (Used w/HEAD, 883 075 C2) |
| 30 | 933 816 C91 | CAP ASSEMBLY (Used w/HEAD, 883 075 C2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

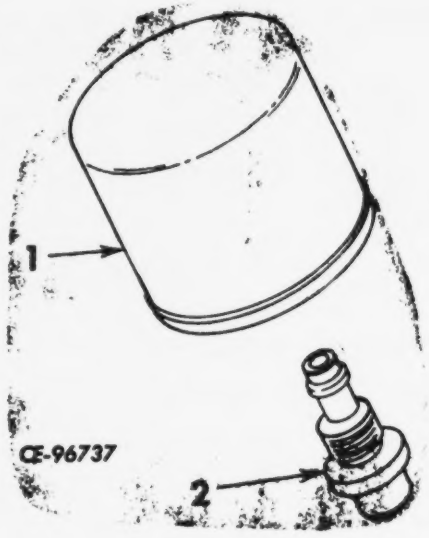
RESERVOIR RELIEF VALVE




| | | |
|---|---|---|
| | 882 845 C91 | VALVE ASSY, reservoir relief (Optional w/VALVE ASSY, 924 390 C91) (Will work for VALVE, 891 496 C91) (Consists of the following parts - |
| 1 | 883 170 C91 | KIT, valve repair |
| 2 | | SEAL, poppet (Not furnished separately) |
| 3 | | SEAL, sleeve (Not furnished separately) |
| 4 | | SEAL, filter (Not furnished separately) |
| 5 | | RING, lock (Not furnished separately) (2) |
| 6 | 927 994 C1 | FILTER |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

RESERVOIR RELIEF VALVE




| | | |
|---|---|---|
| | 891 496 C91 | VALVE (Consists of the following parts) (Order VALVE, 882 845 C91 or VALVE, 924 390 C91) |
| 1 | | CARTRIDGE (Order VALVE, 882 845 C91) |
| 2 | | VALVE, air (Order VALVE 882 845 C91) |



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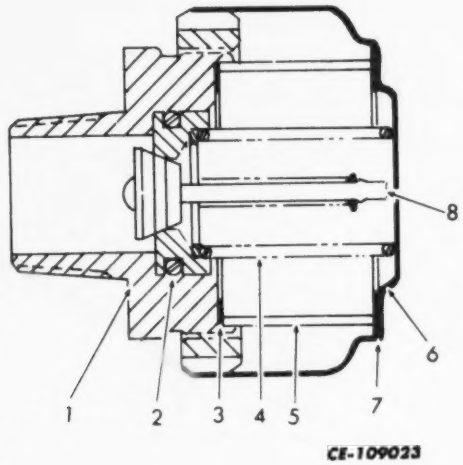
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## RESERVOIR RELIEF VALVE

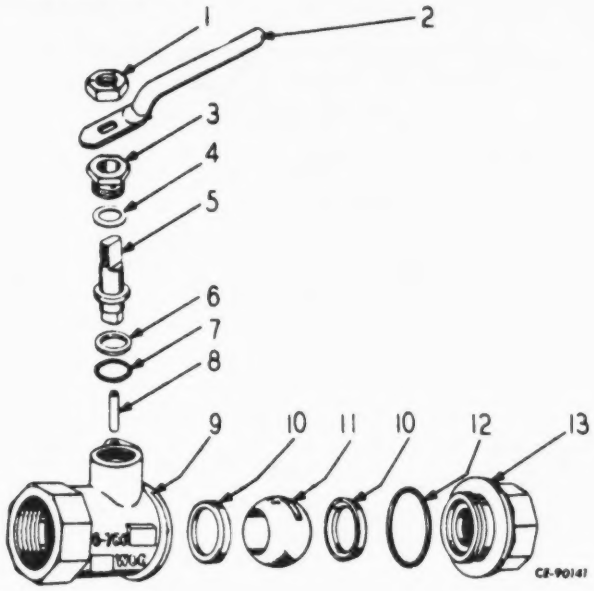



| | | |
|---|---|---|
| | 924 390 C91 | VALVE ASSEMBLY, reservoir relief (Optional w/VALVE ASSY, 882 845 C91) (Will work for VALVE, 891 496 C91) (Consists of the following parts - |
| 1 | | FITTING (Not furnished separately) |
| 2 | | "O" RING (Order KIT, 925 262 C91) |
| 3 | | GASKET (Order KIT, 925 262 C91) |
| 4 | | SPRING (Not furnished separately) |
| 5 | | TUBE (Not furnished separately) |
| 6 | | CAP ASSY (Not furnished separately) |
| 7 | | GASKET (Order KIT, 925 262 C91) |
| 8 | | VALVE ASSY (Not furnished separately) |
| | 925 262 C91 | KIT, valve repair (Consists of - § 1 GASKET § 1 GASKET § 1 "O" RING ) |

§ - Not furnished separately.

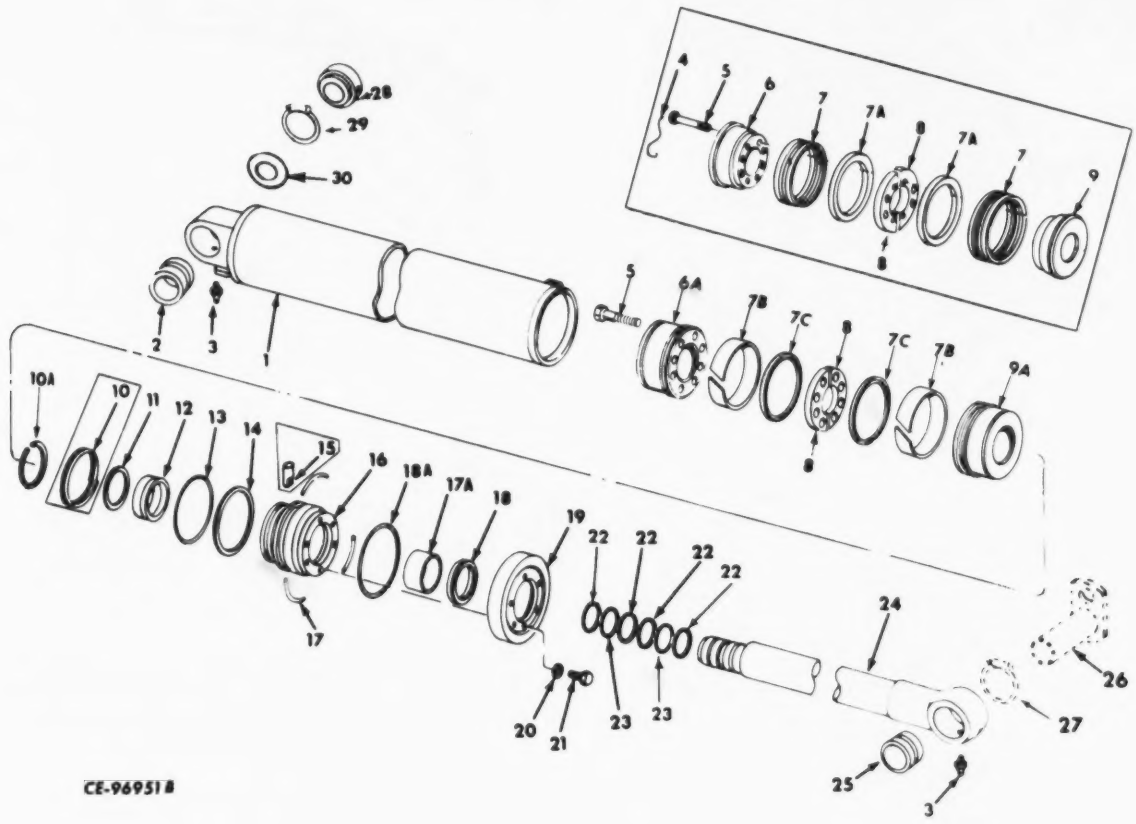
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## RESERVOIR DRAIN VALVE
(Clayton Mark)




| | | |
|---|---|---|
| | 215 605 H1 | VALVE ASSY, reservoir drain (Clayton Mark 780-3/4) (Consists of the following parts) (Order VALVE 891 495 C1) |
| 1 | 217 544 H1 | NUT, lock |
| 2 | 217 545 H1 | HANDLE |
| 3 | 217 546 H1 | NUT, stem bushing |
| 4 | 217 547 H1 | WASHER, thrust |
| 5 | 217 548 H1 | STEM |
| 6 | 217 549 H1 | RING, back-up |
| 7 | 217 550 H1 | SEAL, stem |
| 8 | 217 551 H1 | PIN, stop |
| 9 | 217 552 H1 | BODY |
| 10 | 217 553 H1 | SEAT (2) |
| 11 | 217 554 H1 | BALL |
| 12 | 217 555 H1 | SEAL, body |
| 13 | 217 556 H1 | CAP, end |

BOOM AND LOGGER CYLINDER




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | Parts without letters after the description indicates the part is used for both Cylinders. Letters A & B are used to identify individual Cylinders. |
| A | 883 079 C95 | CYLINDER, boom (6 inch Diameter) (Not used on units equipped with Loader to Logger Kit) (See Note 1) (2) U0* and below C001739 and below |
| B | 920 416 C92 | CYLINDER, logger (7 inch Diameter) (Used only on units equipped with Loader to Logger Kit) (See Note 1) (2) U001935 and below C001739 and below |
| 1 | 176 471 H2 | CYLINDER, w/BUSHING, 193 252 H1 (Cylinder A) |
| 1 | 920 423 C1 | CYLINDER, w/BUSHING, 920 418 C1 (Cylinder B) |
| 2 | 193 252 H1 | BUSHING (Cylinder A) |
| 2 | 920 418 C1 | BUSHING (Cylinder B) |
| 3 | 109 461 | FITTING, grease (Into cylinder body) (Cylinder A) |
| 3 | 109 462 | FITTING, grease (Into piston body) (Cylinder A) |
| 3 | 109 461 | FITTING, grease (Cylinder B) (2) |
| 4 | 876 014 C1 | WIRE, lock (Used with BOLT, 875 926 C1) (Cylinder A) |
| 5 | 875 926 C1 | BOLT, 1/2NC x 3-3/4" (Drilled Hole in head) (Cylinder A) (8) |
| 5 | 25 058 R1 | BOLT, 1/2NC x 3-3/4" (Nylon Pellet) (Cylinder A) (8) |
| 5 | 25 060 R1 | BOLT, 7/8NC x 4" (Nylon Pellet) (Cylinder B) (8) |

(Continued on next page)

* Serial number not available

**BOOM AND LOGGER CYLINDER - Continued**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 6 | 878 441 C3 | PISTON, half (Cylinder A) (Used on Cylinders 883 079 C94 and below) (See Note 1) (Order the following parts - 2 BUSHING 896 464 C1; 1 PISTON HALF 896 466 C2; 1 PISTON HALF 896 467 C2; 2 SEAL 657 862 C1) |
| 6 | 879 308 C3 | PISTON, half (Cylinder B) (Used on Cylinder 920 416 C91) (See Note 1) (Order the following parts - 2 BUSHING 922 722 C1; 1 PISTON HALF 922 723 C1; 1 PISTON HALF 922 724 C1; 2 SEAL 922 721 C1) |
| 6A | 896 466 C2 | PISTON, half (Cylinder A) (Used on Cylinders 883 079 C95) (See Note 1) |
| 6A | 922 724 C1 | PISTON, half (Cylinder B) (Used on Cylinders, 920 416 C92) (See Note 1) |
| 7 | 878 447 C1 | PACKING, piston (Cylinder A) (Used on Cylinders, 883 079 C94 and below) (See Note 1) (2) |
| 7 | 878 064 C1 | PACKING, piston (Cylinder B) (Used on Cylinders, 920 416 C91) (See Note 1) (2) |
| 7A | 878 442 C2 | BUSHING (Cylinder A) (Used on Cylinders, 883 079 C94 and below) (See Note 1) (2) |
| 7A | 878 095 C1 | BUSHING (Cylinder B) (Used on Cylinders 920 416 C91) (See Note 1) (2) |
| 7B | 896 464 C1 | BUSHING (Cylinder A) (Used on Cylinders, 883 079 C95 and up) (See Note 1) (2) |
| 7B | 922 722 C1 | BUSHING (Cylinder B) (Used on Cylinders, 920 416 C92) (See Note 1) (2) |
| 7C | 657 862 C1 | SEAL, (Cylinder A) (Used on Cylinders, 883 079 C95) (See Note 1) (2) |
| 7C | 922 721 C1 | SEAL, (Cylinder B) (Used on Cylinders, 920 416 C92) (See Note 1) (2) |
| 8 | 169 580 H1 | RING, lock (Cylinder A) (2) |
| 8 | 879 307 C1 | RING, lock (Cylinder B) (2) |
| 9 | 878 443 C3 | PISTON, half (Cylinder A) (Used on Cylinders 883 079 C94 and below) (See Note 1) (Order the following parts - 2 BUSHING 896 464 C1; 1 PISTON HALF 896 466 C2; 1 PISTON HALF 896 467 C2; 2 SEAL 657 862 C1) |
| 9 | 896 424 C1 | PISTON, half (Cylinder B) (Used on Cylinder 920 416 C91) (See Note 1) (Order the following parts - 2 BUSHING 922 722 C1; 1 PISTON HALF 922 723 C1; 1 PISTON HALF 922 724 C1; 2 SEAL 922 721 C1) |
| 9A | 896 467 C2 | PISTON, half (Cylinder A) (Used on Cylinder, 883 079 C95) (See Note 1) |
| 9A | 922 723 C1 | PISTON, half (Cylinder B) (Used on Cylinder, 920 416 C92) (See Note 1) |
| 10 | 878 444 C1 | RING, retaining (Cylinder A) U001126 and below C001002 and up |
| 10A | 890 912 C1 | RING, retaining (Cylinder A) U001127 and up |
| 10A | 890 830 C1 | RING, retaining (Cylinder B) |
| 11 | 878 445 C1 | BUSHING (Cylinder A) |
| 11 | 878 094 C1 | BUSHING (Cylinder B) |
| 12 | 890 910 C1 | PACKING, rod (Cylinder A) |
| 12 | 890 835 C1 | PACKING, rod (Cylinder B) |

NOTE 1: Cylinder Assembly 883 079 C95 and 920 416 C92 and up have the Assembly part number stamped on them. Cylinder Assemblies 883 079 C94 and 920 416 C91 and below are not stamped.

(X) - As Required.

BOOM AND LOGGER CYLINDER - Continued

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 13 | 876 101 C1 | "O" RING (Cylinder A) |
| 13 | 876 102 C1 | "O" RING (Cylinder B) |
| 14 | 141 543 H1 | RING, back-up (Cylinder A) U001126 and below C001002 and up |
| 14 | 890 911 C1 | RING, back-up (Cylinder A) U001127 and up |
| 14 | 890 831 C1 | RING, back-up (Cylinder B) |
| 15 | 878 449 C1 | PIN (Used with GLAND, 878 451 C21) (Cylinder A) (3) |
| 16 | 890 913 C1 | GLAND, w/BUSHING, 878 440 C2 (Together with PACKING ROD, 890 910 C1 and RETAINING RING 890 912 C1 will work for GLAND 878 451 C21) (Cylinder A) |
| 16 | 890 761 C91 | GLAND w/BUSHING, 878 065 C2 Cylinder B) |
| 17 | 169 566 H2 | RING, lock (Cylinder A) (3) |
| 17 | 147 872 H1 | RING, lock (Cylinder B) (3) |
| 17A | 878 440 C2 | BUSHING (Cylinder A) |
| 17A | 878 065 C2 | BUSHING (Cylinder B) |
| 18 | 878 448 C91 | SEAL (Cylinder A) |
| 18 | 878 096 C91 | SEAL (Cylinder B) |
| 18A | 878 386 C1 | RING, cord (Cylinder A) |
| 18A | 878 387 C1 | RING, cord (Cylinder B) |
| 19 | 878 450 C1 | CAP (Cylinder A) |
| 19 | 878 099 C1 | CAP (Cylinder B) |
| 20 | 111 328 | WASHER, 3/8 lock (Cylinder A) (6) |
| 20 | 118 975 | WASHER, 1/2" lock (Cylinder B) (6) |
| 21 | 179 838 | BOLT, 3/8NC x 1-1/8" (Cylinder A) (6) |
| 21 | 179 885 | BOLT, 1/2NC x 1-1/2" (Cylinder B) (6) |
| 22 | 878 632 C2 | RING, back-up (Cylinder A) (4) |
| 22 | 878 914 C2 | RING, back-up (Cylinder B) (4) |
| 23 | 876 092 C1 | "O" RING (Cylinder A) (2) |
| 23 | 876 093 C1 | "O" RING (Cylinder B) (2) |
| 24 | 878 078 C11 | ROD w/BUSHING, 169 564 H1, piston (Cylinder A) |
| 24 | 883 078 C11 | ROD w/BUSHING, 169 564 H1, piston (Cylinder B) |
| 25 | 169 564 H1 | BUSHING |
| 26 | | PINLOCK (See Boom and Bucket in Section 17) |
| 27 | | RING CORD (See Boom and Bucket in Section 17) |
| 28 | 176 846 H1 | COLLAR (2) |
| | 25 294 R1 | BOLT (2) |
| 9 | 412 230 | NUT (2) |
| 29 | 890 039 C1 | RING, cord (Together with two WASHERS 118 773, BOLT 26 289 R1 and NUT, 24 468 R1 will work for CORD RING, 169 724 H1) (4) |
| | 26 289 R1 | BOLT, 1/4NF x 4-3/4" (4) |
| | 118 773 | WASHERS, 1/4" (8) |
| | 24 468 R1 | NUT, 1/4NF elastic stop (4) |
| 30 | 889 044 C2 | WASHER (X) |
| | 876 014 C1 | WIRE, bulk locking (13 ga) |

(X) - As Required.



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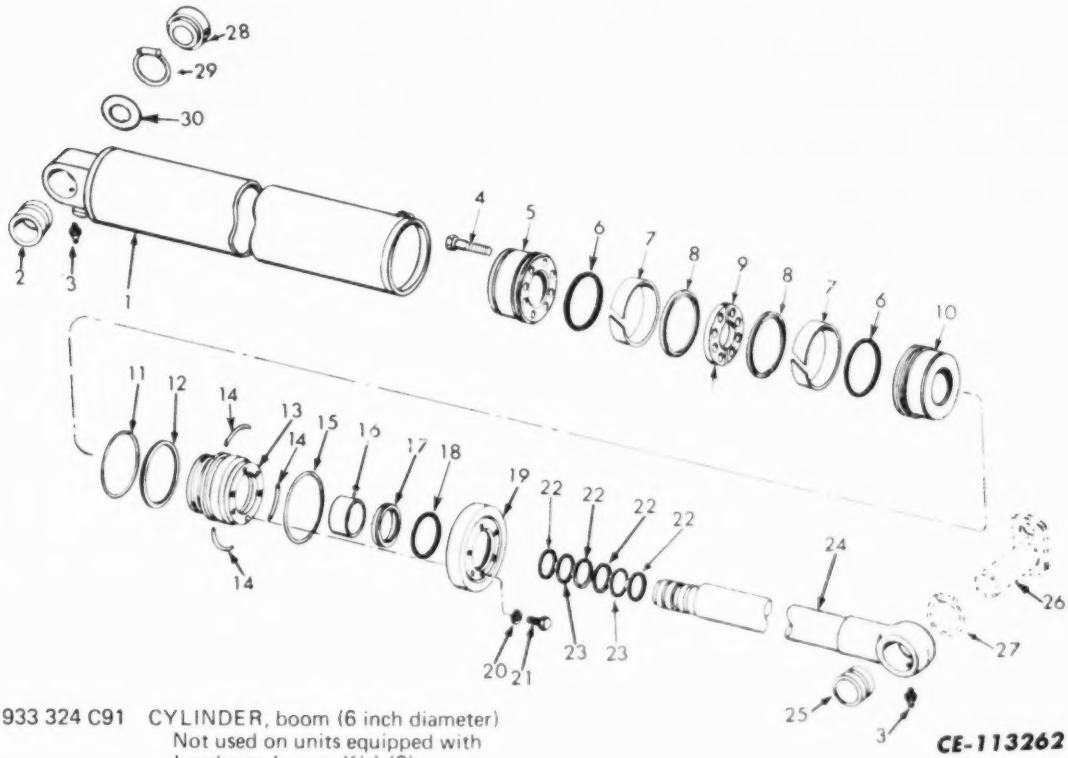
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## BOOM AND LOGGER CYLINDER




CE-113262

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 933 324 C91 | CYLINDER, boom (6 inch diameter) Not used on units equipped with Loader to Logger Kit) (2) U0* and up C001740 and up |
| B | 933 247 C91 | CYLINDER, logger (7 inch diameter) (Used only on units equipped with Loader to Logger Kit) (2) (Consists of Ref. Nos. 1 thru 25 - U001936 and up C001740 and up |
| 1 | 176 471 H2 | CYLINDER w/BUSHING, 193 252 H1 (A) |
| 1 | 920 423 C1 | CYLINDER w/BUSHING, 920 418 C1 (B) |
| 2 | 193 252 H1 | BUSHING (A) |
| 2 | 920 418 C1 | BUSHING (B) |
| 3 | 109 461 | FITTING (Into cylinder body) (A) |
| 3 | 109 461 | FITTING (Into cylinder body) (B) |
| 3 | 109 462 | FITTING (Into piston body) (A) |
| 3 | 109 462 | FITTING (Into piston body) (B) |
| 4 | 25 507 R1 | BOLT (A) (8) |
| 4 | 24 881 R1 | BOLT (B) (8) |
| 5 | 933 277 C1 | PISTON, half (A) |
| 5 | 933 230 C1 | PISTON, half (B) |
| 6 | 26 969 R1 | "O" RING (A) (2) |
| 6 | 343 943 R1 | "O" RING (B) (2) |
| 7 | 933 221 C1 | BUSHING (A) (2) |
| 7 | 933 222 C1 | BUSHING (B) (2) |
| 8 | 657 862 C1 | SEAL (A) (2) |
| 8 | 922 721 C1 | SEAL (B) (2) |
| 9 | 169 580 H1 | RING, lock (A) (2) |
| 9 | 879 307 C1 | RING, lock (B) (2) |
| 10 | 933 276 C1 | PISTON, half (A) |
| 10 | 933 231 C1 | PISTON, half (B) |
| 11 | 876 101 C1 | "O" RING (A) |

* - Serial Number Not Available.

BOOM AND LOGGER CYLINDER - Continued

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 11 | 876 102 C1 | "O" RING (B) |
| 12 | 899 129 C2 | RING, back-up (A) |
| 12 | 899 128 C2 | RING, back-up (B) |
| 13 | 933 269 C1 | GLAND (A) |
| 13 | 933 232 C1 | GLAND (B) |
| 14 | 169 566 H2 | RING, lock (A) (3) |
| 14 | 147 872 H2 | RING, lock (B) (3) |
| 15 | 878 336 C1 | RING, cord (A) |
| 15 | 878 387 C1 | RING, cord (B) |
| 16 | 933 212 C2 | SEAL, rod (A) |
| 16 | 656 498 C1 | SEAL, rod (B) |
| 17 | 933 207 C1 | WIPER, rod (A) |
| 17 | 656 282 C91 | WIPER, rod (B) |
| 18 | 3 046 999 R1 | "O" RING (B) |
| 19 | 933 268 C1 | CAP (A) |
| 19 | 933 229 C1 | CAP (B) |
| 20 | 25 544 R1 | WASHER, hardened (A) (6) |
| 20 | 25 546 R1 | WASHER, hardened (B) (6) |
| 21 | 140 483 H | BOLT (A) (6) |
| 21 | 24 862 R1 | BOLT (B) (6) |
| 22 | 899 130 C2 | RING, back-up (A) (4) |
| 22 | 899 127 C2 | RING, back-up (B) (4) |
| 23 | 876 092 C1 | "O" RING (A) (2) |
| 23 | 876 093 C1 | "O" RING (B) (2) |
| 24 | 883 078 C11 | ROD w/BUSHING, 169 564 H1 (A) |
| 24 | 920 421 C91 | ROD w/BUSHING, 169 564 H1 (B) |
| 25 | 169 564 H1 | BUSHING |
| 26 | | PINLOCK (See Boom and Bucket in Section 17) (#) |
| 27 | | RING, cord (See Boom and Bucket in Section 17) (#) |
| 28 | 176 846 H1 | COLLAR (2) (#) |
| 29 | 890 039 C1 | RING, cord (4) (#) |
| 30 | 889 044 C2 | WASHER (10) (#) |

(#) - Not Part of Cylinder Assembly



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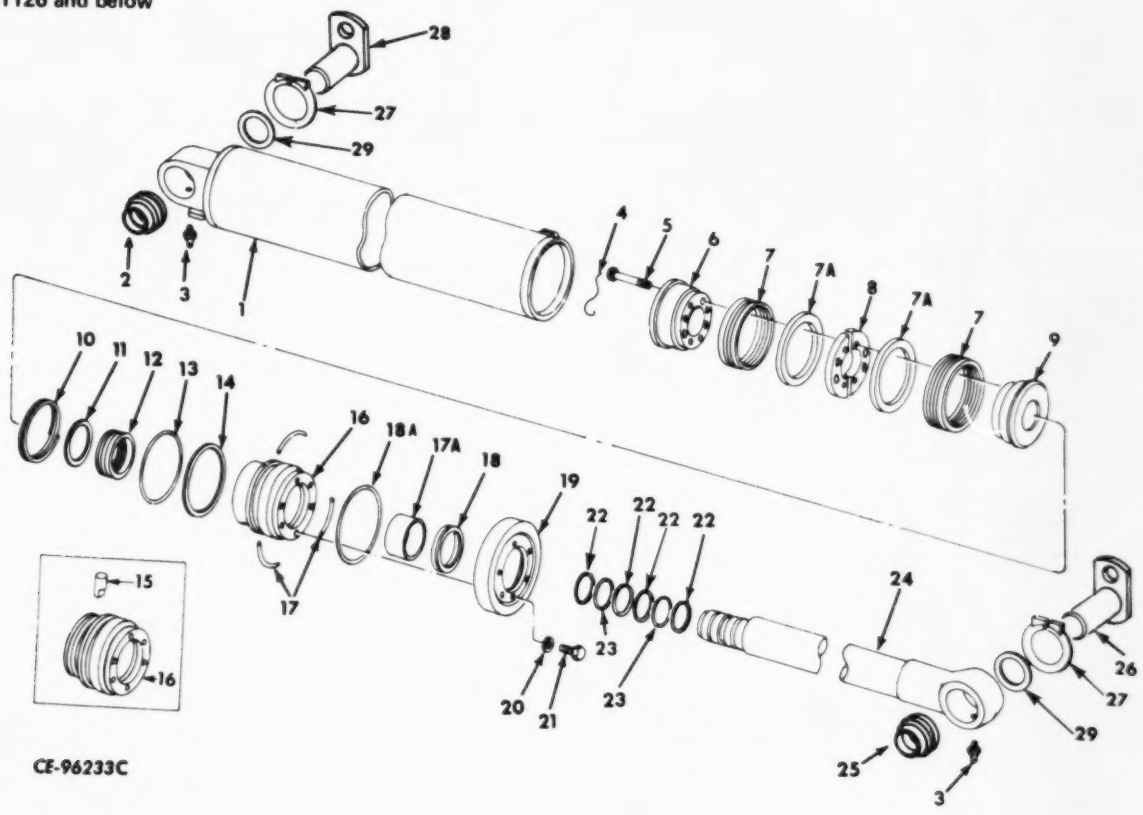
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**BUCKET CYLINDER**
**U001108 and below except 01097**
**C001126 and below**




CE-96233C

| | | |
|---|---|---|
| | 884 199 C92 | CYLINDER, bucket (7 inch Diameter) (Not used with 13' High Lift Boom Kit) (Consists of items 1 thru 25) |
| | 891 862 C91 | CYLINDER, bucket (7 inch Diameter) (Used with 13' High Lift Boom Kit) (Order Cylinder, 893 165 C93) (Consists of items 1 thru 25) |
| 1 | 884 194 C2 | CYLINDER w/BUSHING, 175 907 H1 (Used w/BUCKET CYLINDER, 884 199 C92) |
| 1 | 891 859 C1 | CYLINDER w/BUSHING, 175 907 H1 (Used w/BUCKET CYLINDER, 891 862 C91) |
| 2 | 175 907 H1 | BUSHING |
| 3 | 109 462 | FITTING, grease (2) |
| 4 | 876 014 C1 | WIRE, lock - No. 13 x 17 |
| 5 | 881 047 C1 | BOLT, 5/8NC x 4" (8) |
| 6 | 879 308 C3 | PISTON, half |
| 7 | 878 064 C1 | PACKING, piston (2) |
| 7A | 878 095 C1 | BUSHING (2) |
| 8 | 879 307 C1 | LOCK RING (2) |
| 9 | 879 309 C3 | PISTON, half |
| 10 | 878 090 C1 | RING, retainer (Used w/BUCKET CYLINDER 884 199 C91 only) |
| 10 | 890 830 C1 | RING, retainer (Used w/BUCKET CYLINDER 884 199 C92 and 891 862 C91) |
| 11 | 878 094 C1 | BUSHING |
| 12 | 890 835 C1 | PACKING, rod |
| 13 | 876 102 C1 | "O" RING |
| 14 | 147 865 H1 | WASHER, back-up (Used w/BUCKET CYLINDER, 884 199 C91 only) |
| 14 | 890 831 C1 | WASHER, back-up (Used w/BUCKET CYLINDER, 884 199 C92 and 891 862 C91) |
| 15 | 878 101 C1 | PIN (Used w/BUCKET CYLINDER, 884 199 C91 only) (3) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BUCKET CYLINDER - Continued** |
| | | **U001108 and below except 01097** |
| | | **C001126 and below** |
| 16 | 890 761 C91 | GLAND w/BUSHING 878 065 C2 (Together with 890 835 C1 PACKING ROD and 890 831 C1 WASHER, BACK-UP will work for GLAND, 878 100 C21) |
| 17 | 147 872 H1 | LOCK RING (3) |
| 17A | 878 065 C2 | BUSHING |
| 18 | 878 096 C91 | SEAL |
| 18A | 878 387 C1 | RING, cord |
| 19 | 878 099 C1 | CAP |
| 20 | 25 546 R1 | WASHER, lock (6) |
| 21 | 24 862 R1 | BOLT, 1/2NC x 1-1/2" (6) |
| 22 | 878 914 C2 | RING, back up (4) |
| 23 | 876 093 C1 | "O" RING (2) |
| 24 | 884 197 C91 | ROD, piston w/BUSHING 175 865 H1 (Used w/BUCKET CYLINDER 884 199 C92) |
| 24 | 891 858 C91 | ROD, piston w/BUSHING, 175 865 H1 (Used w/BUCKET CYLINDER 891 862 C91) |
| 25 | 175 865 H1 | BUSHING |
| 26 | | PIN, lock - Cylinder to Bellcrank (See Boom and Bucket in Section 17) |
| 27 | | RING, cord (See Boom and Bucket in Section 17) (2) |
| 27 | 885 934 C1 | RING, cord (Together with two WASHERS 118 773, BOLT 26 290 R1, and NUT, 24 468 R1 will work for CORD RING (Solid Type) 191 417 H1) (2) |
| | 26 290 R1 | 1/4NF x 4-1/4" BOLT (2) |
| | 118 773 | 1/4" WASHER (4) |
| | 24 468 R1 | 1/4NF stop NUT (2) |
| 28 | 175 920 H1 | PINLOCK (Cylinder Pivot at Frame) |
| | 24 884 R1 | SCREW, 1" hex-hd cap (Used w/WASHER, 932 279 C1) |
| | 271 627 | SCREW, 1-1/8" hex-hd cap (Used w/WASHER, 106 268 and WASHER, 103 326) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) |
| | 106 268 | WASHER, flat (Used w/SCREW, 271 627) |
| | 103 326 | WASHER, lock (Used w/SCREW, 271 627) |
| 29 | 890 347 C1 | WASHER (X) |

(X) - As Required.



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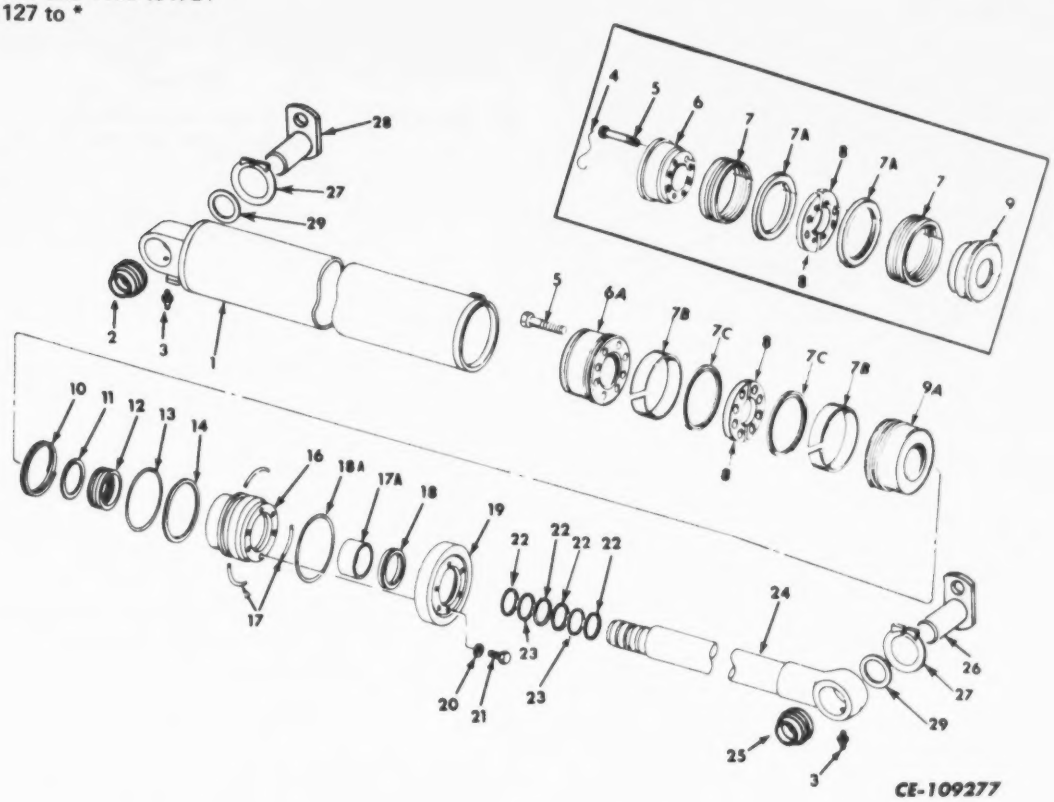
BUCKET CYLINDER - Continued
U001097 and 1109 to1721
C001127 to *




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 892 999 C94 | CYLINDER, bucket (8 inch Diameter) (Not used on units equipped with High Lift Boom) |
| | 893 165 C93 | CYLINDER, bucket (8 inch Diameter) (Used on units equipped with High Lift Boom) (Consists of items 1 thru 25 - |
| 1 | 892 998 C1 | CYLINDER w/BUSHING, 175 907 H1 (Used w/BUCKET CYLINDER 892 999 C94) |
| 1 | 893 168 C1 | CYLINDER w/BUSHING, 175 907 H1 (Used w/BUSHING CYLINDER 893 165 C93) |
| 2 | 175 907 H1 | BUSHING |
| 3 | 109 462 | FITTING, grease (2) |
| 4 | 876 014 C1 | WIRE, lock - No. 13 x 48" (Used with BOLT, 875 934 C1) |
| 5 | 875 934 C1 | BOLT, 5/8NC x 4" (Drilled hole in head) (8) |
| 5 | 24 882 R1 | BOLT, 5/8 NC x 4 1/2" (Nylon Pellet) (8) |
| 6 | 878 197 C3 | PISTON, half (Used w/BUSHING, 878 198 C1 and PACKING, 878 071 C1) (See NOTE 1) (Order the following parts - 2 BUSHING 927 641 C1; 1 PISTON HALF 922 643 C1; 1 PISTON HALF 922 644 C1; 2 SEAL 922 642 C1) |
| 6A | 922 643 C1 | PISTON, half (Used w/BUSHING, 922 641 C1) (See NOTE 1) |
| 7 | 878 071 C1 | PACKING, piston (Used w/PISTON HALF, 878 197 C3 and PISTON HALF, 878 196 C3) (See NOTE 1) (2) |
| | NOTE 1: | Cylinder Assembly, 892 999 C94 and 893 165 C93 have the Assembly part number stamped on them. Cylinder Assembly, 892 999 C93 and below, and 893 165 C92 and below are not stamped. |

* - Serial Number Not Available.

BUCKET CYLINDER - Continued
U001097 and 1109 to 1721
C001127 to *

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 7A | 878 198 C1 | BUSHING (Used w/PISTON HALF, 878 197 C3 and PISTON HALF, 878 196 C3) (See NOTE 1) (2) |
| 7B | 922 641 C2 | BUSHING (Used w/PISTON HALF, 922 643 C1 and PISTON HALF, 927 644 C2) (See NOTE 1) (2) |
| 7C | 922 642 C1 | SEAL (Used w/PISTON HALF, 922 643 C1 and PISTON HALF, 922 644 C1) (See NOTE 1) (2) |
| 8 | 175 915 H1 | LOCK RING (2) |
| 9 | 878 196 C3 | PISTON, half (Used w/BUSHING, 878 198 C1 and PACKING, 878 071 C1) (See NOTE 1) (Order the following parts - 2 BUSHING 922 641 C1; 1 PISTON HALF 922 643 C1; 1 PISTON HALF 922 644 C1; 2 SEAL 922 642 C1) |
| 9A | 922 644 C1 | PISTON, half (Used w/BUSHING, 922 641 C1) (See NOTE 1) |
| 10 | 892 775 C1 | RING, retainer |
| 11 | 878 189 C1 | BUSHING |
| 12 | 892 776 C1 | PACKING, rod |
| 13 | 876 103 C1 | "O" RING |
| 14 | 892 777 C1 | WASHER, back-up |
| 16 | 892 779 C91 | GLAND w/BUSHING, 878 199 C2 |
| 17 | 153 264 H1 | LOCK RING |
| 17A | 878 199 C2 | BUSHING |
| 18 | 878 187 C91 | SEAL |
| 18A | 878 388 C1 | RING, cord |
| 19 | 878 192 C1 | CAP |
| 20 | 25 546 R1 | WASHER (6) |
| 21 | 24 862 R1 | BOLT, 1/2NC x 1-1/2" (6) |
| 22 | 878 914 C2 | RING, back-up (Used on CYLINDER ASSY., 893 165 C94 and below) (4) |
| 22 | 878 954 C2 | RING, back-up (Used on CYLINDER ASSY., 892 999 C93 and below) (4) |
| 23 | 876 094 C1 | "O" RING (2) |
| 24 | 893 170 C91 | ROD, piston w/BUSHING, 190 258 H1 (Used on CYLINDER ASSY, 893 165 C93 and below) |
| 24 | 892 979 C92 | ROD, piston w/BUSHING, 190 258 H1 (Used on CYLINDER ASSY, 892 999 C94 and below) |
| 25 | 190 258 H1 | BUSHING |
| 26 | | PIN, lock - Cylinder to Bellcrank (See Boom and Bucket in Section 17) |
| 27 | | RING, cord (See Boom and Bucket in Section 17) (2) |
| 27 | 885 934 C1 | RING, cord (Together with two WASHERS 118 773, BOLT 26 290 R1 and NUT, 24 468 R1 will work for CORD RING (Solid type) 191 417 H1) (2) |
| | 26 290 R1 | 1/4NF x 4-1/4" BOLT (2) |
| | 118 773 | 1/4" WASHER (4) |
| | 24 468 R1 | 1/4NF stop NUT (2) |
| 28 | 175 920 H1 | PINLOCK (Cylinder Pivot at Frame |
| | 24 884 R1 | SCREW, 1" hex-hd cap (Used w/WASHER, 932 279 C1) |
| | 271 627 | SCREW, 1-1/8" hex-hd cap (Used w/WASHER, 106 268 and WAHSER, 103 326) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) |
| | 106 268 | WASHER, flat (Used w/SCREW, 271 627) |
| | 103 326 | WASHER, lock (Used w/SCREW, 271 627) |
| 29 | 890 347 C1 | WASHER (X) |

NOTE 1: Cylinder Assembly, 892 999 C94 and 893 165 C93 have the Assembly part number stamped on them. Cylinder Assembly, 892 999 C93 and below, and 893 165 C92 and below are not stamped.

(X) - As Required.

* - Serial Number Not Available.



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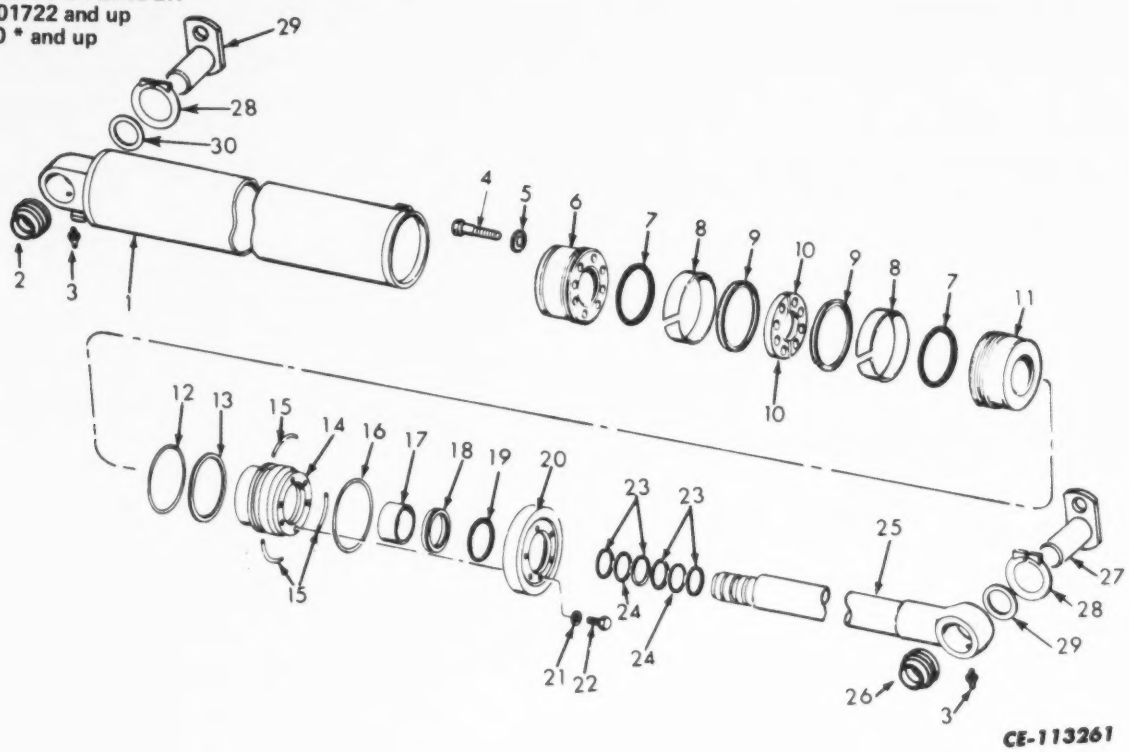
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

BUCKET CYLINDER
U001722 and up
C00 * and up




CE-113261

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 933 351 C91 | CYLINDER, bucket (8 inch Diameter) (Not used on units equipped with High Lift Boom) |
| B | 933 352 C91 | CYLINDER, bucket (8 inch Diameter) (Used on units equipped with High Lift Boom) (Consists of the following |
| 1 | 892 998 C1 | CYLINDER w/BUSHING, 175 907 H1 (A) |
| 1 | 893 168 C1 | CYLINDER w/BUSHING, 175 907 H1 (B) |
| 2 | 175 907 H1 | BUSHING |
| 3 | 109 462 | FITTING (A) (2) |
| 3 | 109 460 | FITTING (B) (2) |
| 4 | 24 882 R1 | BOLT (8) |
| 5 | 25 537 R1 | WASHER, hardened (A) (8) |
| 6 | 933 228 C1 | PISTON, half |
| 7 | 343 929 R1 | "O" RING (2) |
| 8 | 933 223 C1 | BUSHING (2) |
| 9 | 922 642 C2 | SEAL (2) |
| 10 | 175 915 H1 | LOCKRING (2) |
| 11 | 933 244 C1 | PISTON, half |
| 12 | 876 103 C1 | "O" RING |
| 13 | 933 283 C1 | RING, back-up |
| 14 | 933 243 C1 | GLAND |
| 15 | 153 264 H2 | LOCK RING (3) |
| 16 | 878 388 C1 | RING, cord |
| 17 | 933 213 C1 | SEAL, rod |
| 18 | 933 208 C1 | WIPER, rod |
| 19 | 390 610 R1 | "O" RING |
| 20 | 933 246 C1 | CAP |
| 21 | 25 546 R1 | WASHER, hardened (6) |
| 22 | 24 862 R1 | BOLT (6) |
| 23 | 933 282 C1 | RING, back-up (4) |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BUCKET CYLINDER - Continued** |
| | | **U001722 and up** |
| | | **C00 * and up** |
| 24 | 876 094 C1 | "O" RING (2) |
| 25 | 892 979 C92 | ROD, piston w/BUSHING, 190 258 H1 (A) |
| 25 | 893 170 C91 | ROD, piston w/BUSHING, 190 258 H1 (B) |
| 26 | 190 258 H1 | BUSHING |
| 27 | | PIN, lock (Cylinder to Bellcrank) (See Boom and Linkage in Section 17) (#) |
| 28 | | RING, cord (See Boom and Linkage in Section 17) (2) (#) |
| 29 | 175 920 H1 | PINLOCK (Cylinder Pivot at Frame) (#) |
| | 24 884 R1 | BOLT |
| | 932 279 C1 | WASHER, hardened |
| 30 | 890 347 C1 | WASHER (6) |

* - Serial Number Not Available.

(#) - Not Part of Cylinder Assembly.



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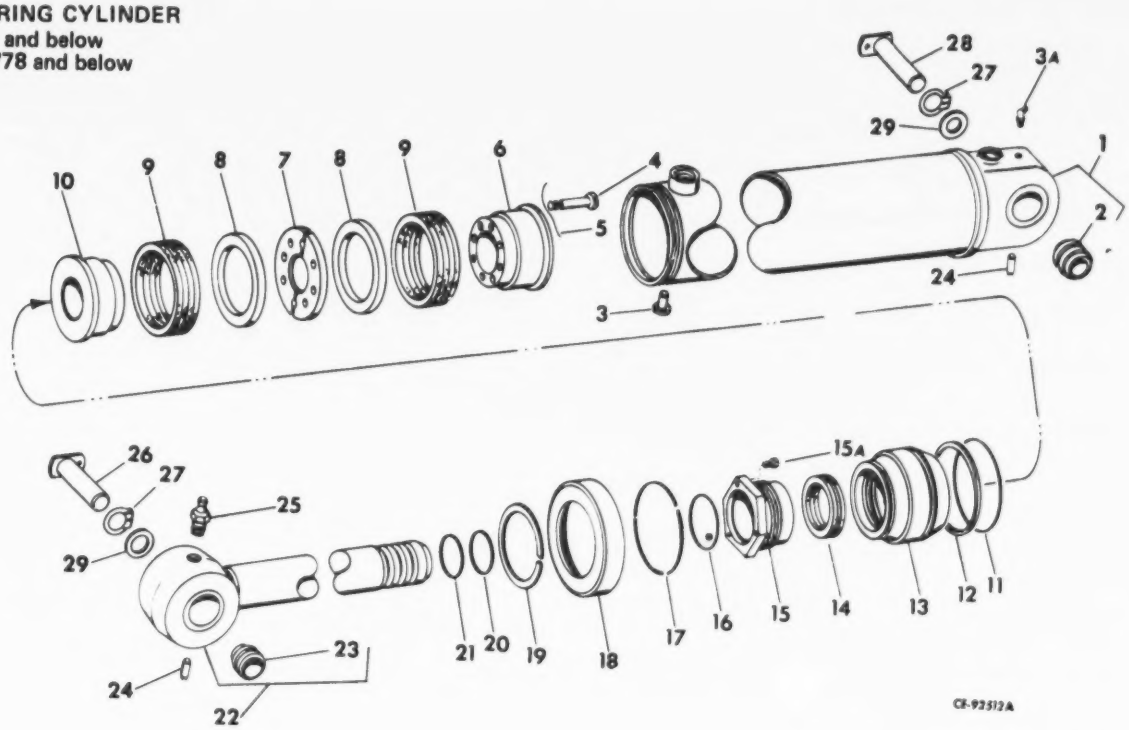
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**STEERING CYLINDER**
**U00 * and below**
**C001778 and below**




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 883 409 C93 | CYLINDER, steering (4-1/2 inch Diameter) (Consists of items 1 thru 25) (2) |
| 1 | 199 383 H2 | CYLINDER w/BUSHING 128 107 H1 |
| 2 | 128 107 H1 | BUSHING |
| 3 | 152 039 H1 | PLUG |
| 3A | 109 462 | FITTING, grease |
| 4 | 875 915 C1 | BOLT, 3/8NC x 2-3/4" Drilled Hole in head) (8) |
| 4 | 21 396 R1 | BOLT, 3/8NC x 2-3/4 (Nylon Pellet) (8) |
| 5 | | WIRE, locking (16 ga. x 14" long) (Cut from bulk WIRE, 278 027 R1) (Used with BOLT, 875 915 C1) |
| 6 | 880 524 C3 | PISTON, half |
| 7 | 880 527 C1 | RING, lock (2) |
| 8 | 880 526 C1 | BUSHING (2) |
| 9 | 880 525 C1 | PACKING, piston (2) |
| 10 | 880 523 C3 | PISTON, half |
| 11 | 876 097 C1 | "O" RING |
| 12 | 894 206 C1 | WASHER, back-up |
| 13 | 174 297 H1 | CAP |
| 14 | 878 147 C1 | PACKING, rod |
| 15 | 880 522 C2 | NUT, packing |
| 15A | 174 304 H1 | SCREW, set (3) |
| 16 | 878 169 C91 | SEAL |
| 17 | 174 299 H1 | LOCK RING (3) |
| 18 | 174 300 H1 | CAP |
| 19 | 174 301 H1 | RING, retaining |
| 20 | 876 088 C1 | "O" RING (2) |
| 21 | 880 521 C2 | RING, back-up (4) |
| 22 | 883 408 C11 | ROD, w/BUSHING, 128 107 H1, piston |

* - Serial Number Not Available

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **STEERING CYLINDER - Continued** |
| | | **U00 * and below** |
| | | **C001778 and below** |
| 23 | 128 107 H1 | BUSHING |
| 24 | 884 483 C1 | SCREW, set "Nylok" 1/2-20 x 1" (2) |
| 25 | 109 461 | FITTING, grease |
| 26 | 199 265 H1 | PINLOCK (Cylinder to Front Frame) (2) |
| | 24 859 R1 | SCREW, 3/4" hex-hd cap (Used w/WASHER, 932 278 C1) (2) |
| | 181 426 | SCREW, 7/8" hex-hd cap (Used w/WASHER, 106 265 and WASHER, 103 323) (2) |
| | 932 278 C1 | WASHER, flat (Used w/SCREW, 24 859 R1) (2) |
| | 106 265 | WASHER, flat (Used w/SCREW, 181 426) (2) |
| | 103 323 | WASHER, lock (Used w/SCREW, 181 426) (2) |
| 27 | 890 300 C1 | CORD, ring (together with two WASHER, 118 773, BOLT, 26 289 R1, NUT, 24 468 R1 will work for Cord Ring (Solid Type) 181 613 H1) (8) |
| | 118 773 | WASHER (16) |
| | 26 289 R1 | BOLT, 1/4NF x 4" (8) |
| | 24 468 R1 | NUT, 1/4NF elastic stop (8) |
| 28 | 199 263 H1 | PINLOCK (Cylinder to Rear Frame) (2) |
| | 24 859 R1 | SCREW, 3/4" hex-hd cap (Used w/WASHER, 932 278 C1( (2) |
| | 181 426 | SCREW, 7/8" hex-hd cap (Used w/WASHER, 106 265 and WASHER, 103 323) (2) |
| | 932 278 C1 | WASHER, flat (Used w/SCREW, 24 859 R1) (2) |
| | 106 265 | WASHER, flat (Used w/SCREW, 181 426) (2) |
| | 103 323 | WASHER, lock (Used w/SCREW, 181 426) (2) |
| 29 | 3 073 523 R1 | WASHER (4) |
| | 278 027 R1 | WIRE, bulk locking (16 ga.) 50 ft. (X) |

* - Serial Number Not Available.

(X) - As Required.



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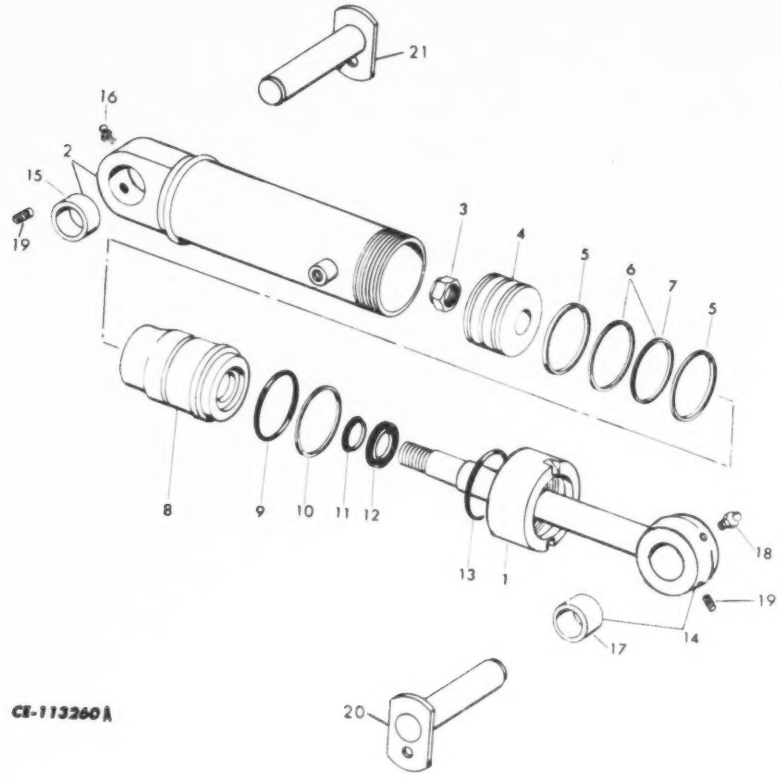
**STEERING CYLINDER**
**U0* and up**
**C001779 and up**




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 933 489 C92 | CYLINDER ASSEMBLY, steering (2)<br>(Consists of items 1 thru 19 - |
| 1 | 940 680 C2 | CAP, retaining |
| 2 | 933 488 C1 | CYLINDER w/BUSHING, 128 107 H1 |
| 3 | 933 490 C1 | NUT<br>U001963 and below<br>C001957 and below<br>(Order the following parts -<br>1 NUT 20 513 R1<br>1 ROD 933 486 C92) |
| 3 | 20 513 R1 | NUT<br>U001964 and up<br>C001958 and up |
| 4 | 936 141 C1 | PISTON |
| 5 | 399 719 R1 | RING, piston wear (2) |
| 6 | 656 450 C1 | SEAL ASSEMBLY |
| 7 | | SEAL, inner (Not furnished separately) |
| 8 | 936 092 C1 | GLAND |
| 9 | 876 097 C1 | "O" RING |
| 10 | 399 717 R1 | RING, back-up |
| 11 | 656 309 C1 | SEAL |
| 12 | 619 069 C91 | WIPER, rod |
| 13 | 384 349 R1 | "O" RING |
| 14 | 933 486 C91 | ROD ASSY<br>U001963 and below<br>C001957 and below<br>(Order the following parts -<br>1 NUT 20 513 R1<br>1 ROD 933 486 C92 |
| 14 | 933 486 C92 | ROD ASSY<br>U001964 and up<br>C001958 and up |
| 15 | 128 107 H1 | BUSHING |

* - Serial Number Not Available.

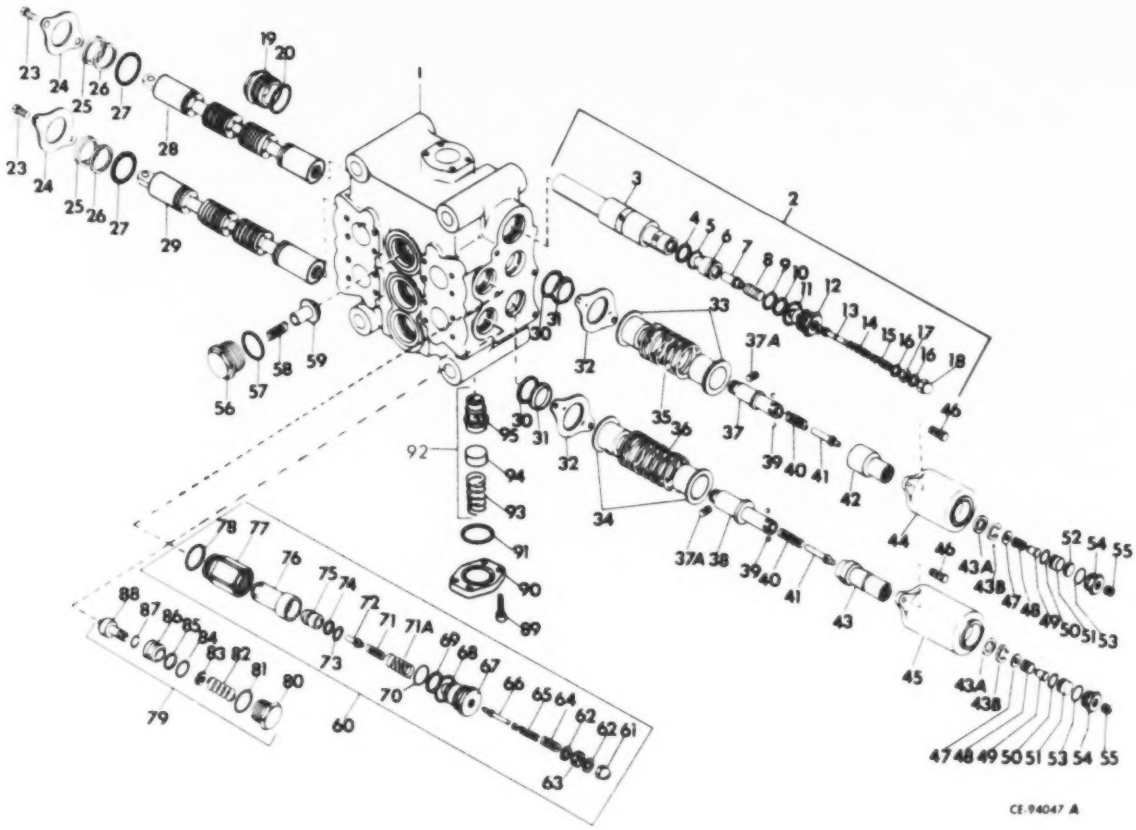
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **STEERING CYLINDER – Continued** | | |
| **U0* and up** | | |
| **C001779 and up** | | |
| 16 | 109 462 | FITTING |
| 17 | 128 107 H1 | BUSHING |
| 18 | 109 461 | FITTING |
| 19 | 884 483 C1 | SCREW, set (2) |
| 20 | 199 263 H1 | PINLOCK, cylinder to rear frame (#) (2) |
| | 24 859 R1 | BOLT, 1/2"NC x 3/4" long (2) |
| | 932 278 C1 | WASHER, hardened (2) |
| 21 | 199 265 H1 | PINLOCK, cylinder to front frame (#) (2) |
| | 24 859 R1 | BOLT, 1/2"NC x 3/4" long (2) |
| | 932 278 C1 | WASHER, hardened (2) |
| | 1 101 392 C1 | COMPOUND |

* - Serial Number Not Available.

(#) - Not part of STEERING CYLINDER ASSEMBLY.

MEMORANDA

MAIN CONTROL VALVE
(2 Spool)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 875 176 C94 | VALVE ASSEMBLY (Order VALVE, 875 176 C96) |
| B | 875 176 C96 | VALVE ASSEMBLY (Consists of the following |
| 1 | | HOUSING, valve (Not Serviced Separately) |
| 2 | 894 848 C91 | CARTRIDGE, relief valve (A) |
| 2 | 942 700 C91 | CARTRIDGE, relief valve (B) |
| 3 | 894 849 C1 | SLEEVE |
| 4 | 875 718 C2 | RING, back-up |
| 5 | 876 065 C1 | "O" RING |
| 6 | 875 709 C1 | POPPET |
| 7 | 208 940 H1 | PISTON (A) |
| 7 | 942 531 C1 | PISTON (B) |
| 8 | 208 937 H1 | SPRING |
| 9 | 876 065 C1 | "O" RING |
| 10 | 875 718 C2 | RING, back-up |
| 11 | 876 111 C1 | "O" RING |
| 12 | 875 719 C1 | PLUG, special |
| 13 | 208 939 H1 | POPPET |
| 14 | 208 941 H1 | SPRING |
| 15 | 208 942 H1 | SCREW, adjusting (A) |
| 15 | 942 528 C1 | SCREW, adjusting (B) |
| 16 | 208 943 H1 | WASHER |
| 17 | 208 944 H1 | NUT |
| 18 | 208 945 H1 | NUT, acorn |
| 19 | 156 801 H1 | PLUG, relief valve |
| 20 | 894 773 C1 | "O" RING (A) |
| 20 | 876 111 C1 | "O" RING (B) |
| 23 | 28 092 R1 | BOLT, 1/2"NC x 3/4" (4) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **MAIN CONTROL VALVE (2 Spool) - Continued** | | |
| 24 | 156 821 H1 | PLATE, seal (A) (2) |
| 24 | 942 693 C1 | PLATE, seal (B) (2) |
| 25 | 942 695 C1 | RING, scraper (2) |
| 26 | 942 694 C1 | RING, seal (2) |
| 27 | 212 955 H1 | "O" RING (2) |
| 28 | | PLUNGER, double acting (Not Serviced Separately) |
| 29 | | PLUNGER, double acting float (Not Serviced Separately) |
| 30 | 212 955 H1 | "O" RING (A) (2) |
| 30 | 942 694 C1 | RING, seal (B) (2) |
| 31 | 942 695 C1 | RING, scraper (2) |
| 32 | 156 821 H1 | PLATE, seal (A) (2) |
| 32 | 942 693 C1 | PLATE, seal (B) (2) |
| 33 | 192 688 H1 | SEAL, spring (2) |
| 34 | 165 794 H1 | SEAT, spring (2) |
| 35 | 192 689 H1 | SPRING, plunger |
| 36 | 192 689 H1 | SPRING, plunger |
| 37 | 192 691 H1 | PIN, plunger |
| 37A | 214 496 H1 | INSERT, nylon (2) |
| 38 | 192 697 H1 | PIN, detent |
| 39 | 16 012 R1 | BALL (8) |
| 40 | 192 693 H1 | SPRING (2) |
| 41 | 214 491 H2 | CAM, detent (2) |
| 42 | 214 493 H1 | SLEEVE, detent |
| 43 | 214 492 H1 | SLEEVE, detent |
| 43A | 214 495 H1 | SPACER (2) |
| 43B | 214 494 H1 | RING, snap (2) |
| 44 | 214 490 H1 | CAP, plunger |
| 45 | 214 490 H1 | CAP, plunger |
| 46 | 380 286 R1 | BOLT, 1/2"NC x 1-1/2" (4) |
| 47 | 615 031 R1 | WASHER, 5/16" flat (2) |
| 48 | 878 221 C1 | SPRING (2) |
| 49 | 878 223 C1 | PIN, guide (2) |
| 50 | 881 132 C1 | "O" RING (2) |
| 51 | 878 222 C1 | PISTON (A) (2) |
| 51 | 934 692 C1 | PISTON (B) (2) |
| 52 | 192 699 H1 | SPACER |
| 53 | 876 108 C1 | "O" RING (2) |
| 54 | 878 224 C1 | PLUG (2) |
| 55 | 444 691 | PLUG, 1/4" - 18 soc. hd. (2) |
| 56 | 156 812 H2 | PLUG, check valve (3) |
| 57 | 876 111 C1 | "O" RING (3) |
| 58 | 156 813 H1 | SPRING, check valve (3) |
| 59 | 156 814 H1 | POPPET, check valve (3) |
| 60 | 216 971 H1 | VALVE, cylinder relief assy (A) (2) |
| 60 | 942 699 C91 | VALVE, cylinder relief assy (B) (2) |
| 61 | 208 945 H1 | NUT, castle (2) |
| 62 | 208 943 H1 | WASHER (4) |
| 63 | 208 944 H1 | NUT, jam (2) |
| 64 | 208 942 H1 | SCREW, adjust (A) (2) |
| 64 | 942 528 C1 | SCREW, adjust (B) (2) |
| 65 | 208 941 H1 | SPRING (2) |
| 66 | 208 939 H1 | POPPET (2) |
| 67 | 208 948 H1 | PLUG (2) |
| 68 | 876 111 C1 | "O" RING (2) |
| 69 | 1 130 737 C1 | RING, back-up (2) |
| 70 | 876 070 C1 | "O" RING (2) |
| 71 | 208 937 H1 | SPRING (2) |
| 71A | 212 502 H1 | SPRING (2) |
| 72 | 208 940 H1 | PISTON (A) (2) |
| 72 | 942 531 C1 | PISTON (B) (2) |
| 73 | 876 038 C1 | "O" RING (2) |
| 74 | 1 130 739 C1 | RING, back-up (2) |
| 75 | 208 947 H1 | POPPET (2) |
| 76 | 208 949 H1 | POPPET (A) (2) |
| 76 | 942 698 C1 | POPPET (B) (2) |
| 77 | 208 938 H1 | CAP (2) |
| 78 | 876 111 C1 | "O" RING (2) |
| 79 | 208 561 H2 | VOID CONTROL ASSEMBLY (2) |
| 80 | 208 934 H1 | PLUG (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **MAIN CONTROL VALVE (2 Spool) - Continued** |
| 81 | 876 111 C1 | "O" RING (2) |
| 82 | 212 501 H1 | SPRING (2) |
| 83 | 17 296 R1 | NUT (2) |
| 84 | 876 070 C1 | "O" RING (2) |
| 85 | 208 933 H2 | RING, back-up (2) |
| 86 | 212 498 H1 | SPACER (2) |
| 87 | 876 066 C1 | "O" RING (2) |
| 88 | 212 499 H1 | POPPET (2) |
| 89 | 380 286 R1 | SCREW (4) |
| 90 | 176 197 H1 | PLATE, end |
| 91 | 876 077 C1 | "O" RING |
| 92 | 883 139 C1 | CHECK VALVE SERVICE KIT |
| 93 | 883 168 C1 | SPRING |
| 94 | | NOT USED |
| 95 | 883 166 C1 | POPPET |



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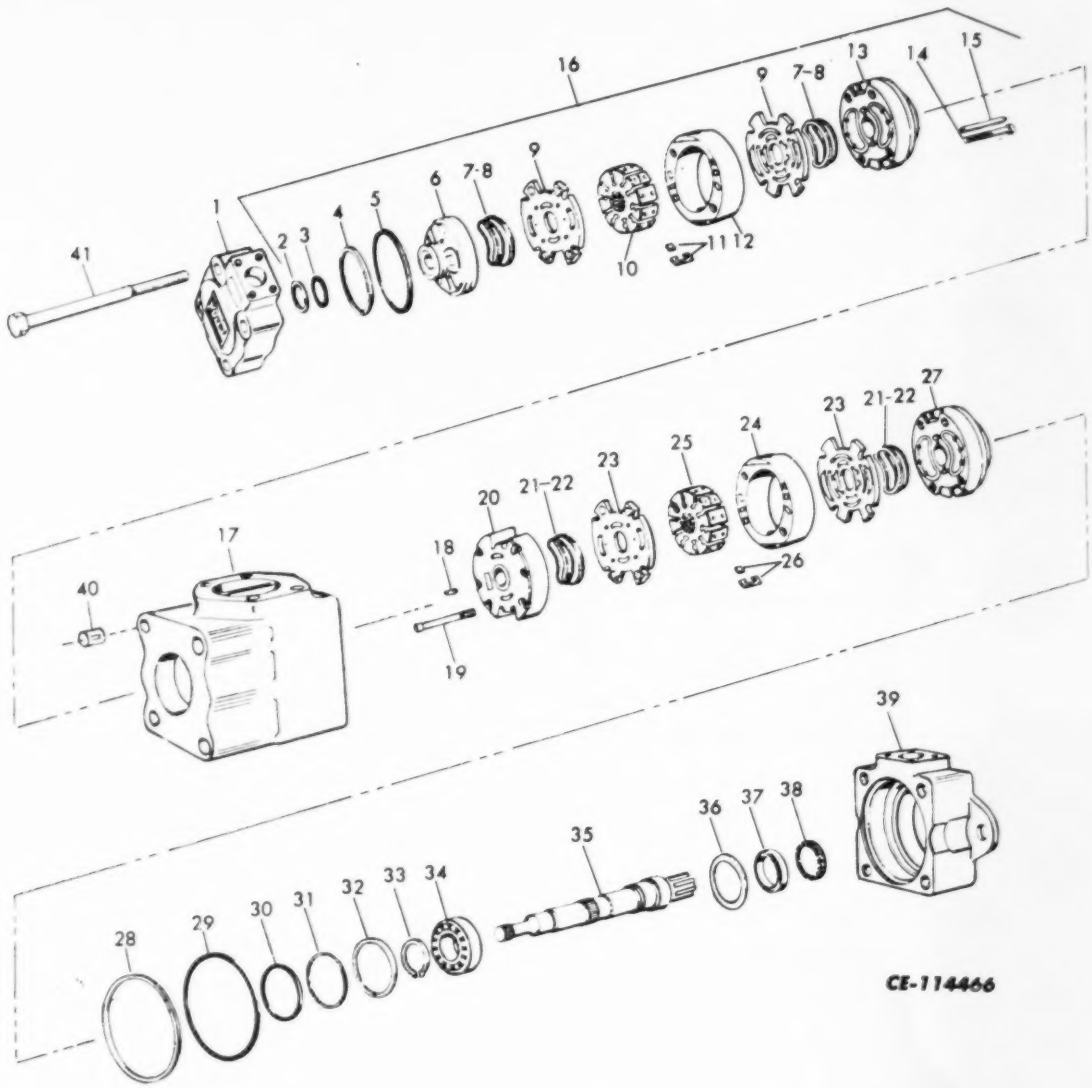
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

**MAIN HYDRAULIC PUMP**
**U001108 and below except 01097**
**C001126 and below**




| | | | | |
|---|---|---|---|---|
| | 890 340 C91 | PUMP, main (Consists of the following parts - | 5 | "O" RING, cover (#) (+) |
| 1 | 201 182 H2 | COVER | 6 | PLATE, outlet support (#) |
| 2 | | RING, backup (#) (+) | 7 | "O" RING (#) (4) |
| 3 | | "O" RING (#) (+) | 8 | RETAINER, oil seal (#) (4) |
| 4 | | RING, sealing (#) (+) | | (#) - Part of CARTRIDGE KIT, 1 132 161 C1<br>(+) - Part of SEAL KIT, 201 189 H1 |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **MAIN HYDRAULIC PUMP – Continued U001108 and below except 01097 C001126 and below** | | |
| 9 | | PLATE, flex side (#) (2) |
| 10 | | ROTOR (#) |
| 11 | | VANE & INSERT (#) (10) |
| 12 | | RING (#) |
| 13 | | PLATE, inlet (#) |
| 14 | | BOLT (#) (2) |
| 15 | | PIN (#) (2) |
| 16 | 1 132 161 C1 | KIT, cartridge (25 GPM) (Replaces 185 354 H3) |
| 17 | 894 812 C92 | HOUSING w/eight BUSHINGS, 894 592 C1 |
| 18 | | PIN (%) (2) |
| 19 | | BOLT (%) (2) |
| 20 | | PLATE, inlet (%) |
| 21 | | "O" RING (%) (4) |
| 22 | | RETAINER (%) (4) |
| 23 | | PLATE, flex side (%) (2) |
| 24 | | RING (%) |
| 25 | | ROTOR (%) |
| 26 | | VANE & INSERT (%) (10) |
| 27 | | PLATE, outlet support (%) |
| 28 | | "O" RING (%) (+) |
| 29 | | RING, sealing (%) (+) |
| 30 | | "O" RING (%) (+) |
| 31 | | RING, back up (%) (+) |
| 32 | 299 899 R1 | RING, lock |
| 33 | 659 380 R1 | RING, snap |
| 34 | 610 391 C91 | BEARING |
| 35 | 201 187 H1 | SHAFT |
| 36 | 165 022 H1 | WASHER |
| 37 | 163 896 H1 | WIPER (+) |
| 38 | 165 023 H2 | SEAL (+) |
| 39 | 163 897 H3 | BODY |
| 40 | 894 592 C1 | BUSHING (8) |
| 41 | 204 983 H1 | BOLT (4) |
| | 1 132 169 C1 | KIT, cartridge 50 GPM (Consists of items 18 thru 31) (Replaces 932 476 C91) |
| | 201 189 H1 | KIT, seal (Consists of items 2 thru 5, 28, 29, 30, 31 and 37 thru 38) |

(#) - Part of CARTRIDGE KIT, 1 132 161 C1
(+) - Part of SEAL KIT, 201 189 H1
(%) - Part of CARTRIDGE KIT, 1 132 169 C1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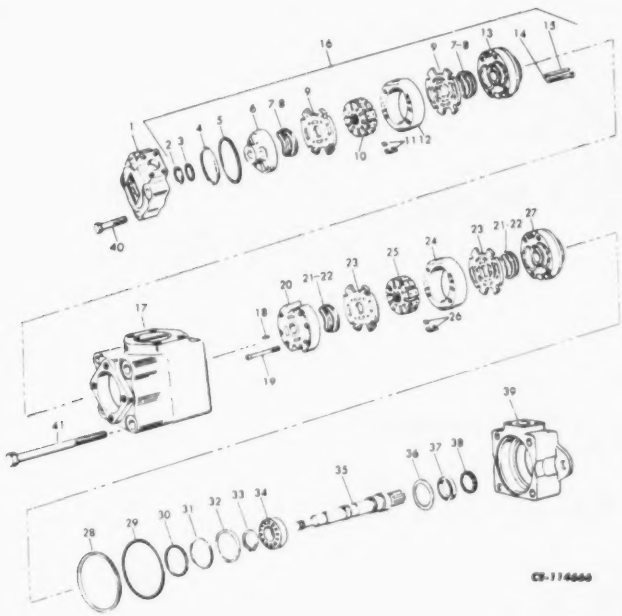
**MAIN HYDRAULIC PUMP**
**U001109 and up, also 01097**
**C001127 and up**



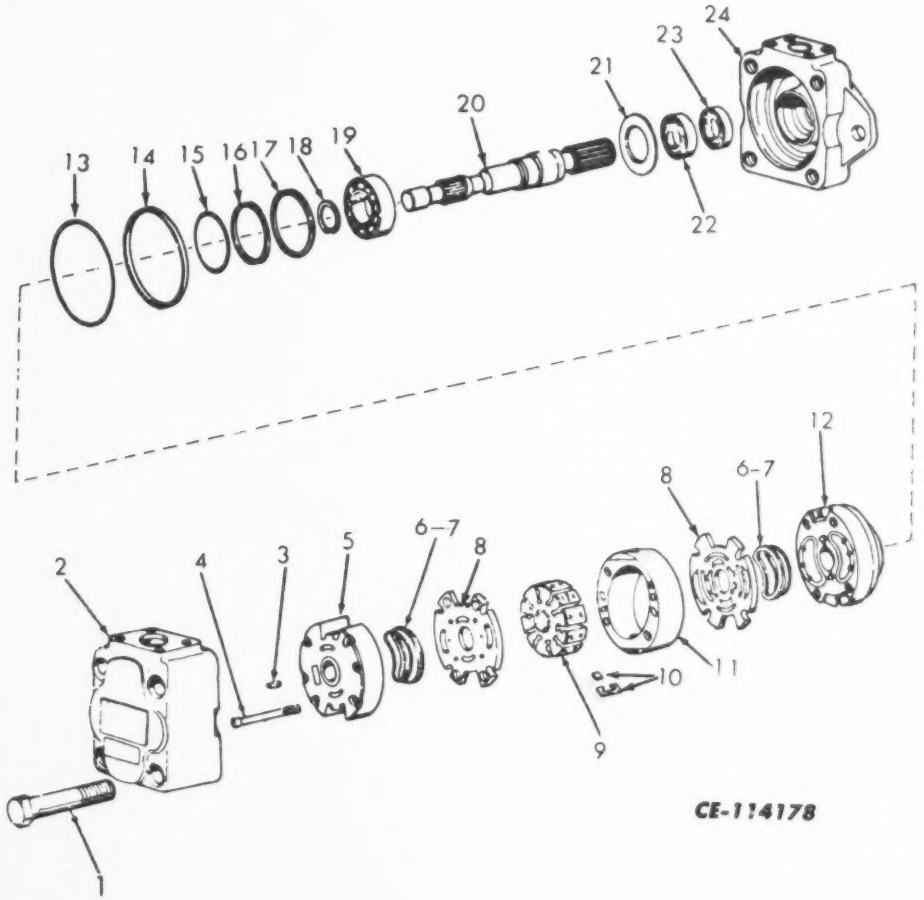
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 893 337 C91 | PUMP, main (Consists of the following parts - |
| 1 | 180 173 H1 | COVER |
| 2 | | RING, back up (#) (+) |
| 3 | | "O" RING (#) (+) |
| 4 | | RING, sealing (#) (+) |
| 5 | | "O" RING, cover (#) (+) |
| 6 | | PLATE, outlet support (#) |
| 7 | | "O" RING (#) (4) |
| 8 | | RETAINER, oil seal (#) (4) |
| 9 | | PLATE, flex side (#) (2) |
| 10 | | ROTOR (#) |
| 11 | | VANE & INSERT (#) (10) |
| 12 | | RING (#) |
| 13 | | PLATE, inlet (#) |
| 14 | | BOLT (#) (2) |
| 15 | | PIN (#) (2) |
| 16 | 1 132 157 C1 | KIT, cartridge (21 GPM) (Replaces 196 416 H3) |
| 17 | 196 418 H1 | HOUSING |
| 18 | | PIN (%) (2) |
| 19 | | BOLT (%) (2) |
| 20 | | PLATE, inlet (%) |
| 21 | | "O" RING (%) (4) |
| 22 | | RETAINER (%) (4) |
| 23 | | PLATE, flex side (%) (2) |
| 24 | | RING (%) |
| 25 | | ROTOR (%) |
| 26 | | VANE & INSERT (%) (10) |
| 27 | | PLATE, outlet support (%) |
| 28 | | "O" RING (%) (+) |
| 29 | | RING, sealing (%) (+) |
| 30 | | "O" RING (%) (+) |
| 31 | | RING, back up (%) (+) |
| 32 | 616 518 R1 | RING, lock |
| 33 | 301 020 R1 | RING, snap |

(#) - Part of CARTRIDGE KIT, 1 132 157 C1.
(+) - Part of SEAL KIT, 196 415 H2.
(%) - Part of CARTRIDGE KIT, 193 703 H4.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **MAIN HYDRAULIC PUMP – Continued** |
| | | **U001109 and up, also 01097** |
| | | **C001127 and up** |
| 34 | 164 372 H1 | BEARING |
| 35 | 196 419 H1 | SHAFT |
| 36 | 165 003 H1 | WASHER |
| 37 | | WIPER (+) |
| 38 | | SEAL (+) |
| 39 | 164 373 H3 | BODY |
| 40 | 19 992 R1 | BOLT (4) |
| 41 | 17 184 R1 | BOLT (4) |
| | 193 703 H4 | KIT, cartridge 38 GPM (Consists of items 18 thru 31) |
| | 196 415 H2 | KIT, seal (Consists of items 2 thru 5, 28, 29, 30, 31 and 37 thru 38) |

(+) - Part of SEAL KIT, 196 415 H2

STEERING PUMP
U001109 and up, also 01097
C001127 and up




CE-114178

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 879 087 C93 | STEERING PUMP ASSY (Consists of the following parts - |
| 1 | 185 356 H1 | COVER |
| 2 | 185 355 H1 | BOLT (4) |
| 3 | | PIN (*) (2) |
| 4 | | SCREW (*) (2) |
| 5 | | PLATE, inlet support (*) |
| 6 | | RETAINER, oil seal (*) (4) |
| 7 | | "O" RING (*) (4) |
| 8 | | PLATE, flex side (*) (2) |
| 9 | | ROTOR (*) |
| 10 | | VANE & INSERT (*) (10) |
| 11 | | RING (*) |
| 12 | | PLATE, outlet support (*) |
| 13 | | "O" RING (*) (#) |
| 14 | | RING, sealing (*) (#) |
| 15 | | "O" RING (*) (#) |
| 16 | | RING, back up (*) (#) |
| 17 | 616 518 R1 | RING, spirolox |
| 18 | 301 020 R1 | RING, retaining |
| 19 | 164 372 H1 | BEARING |
| 20 | 185 358 H1 | SHAFT |

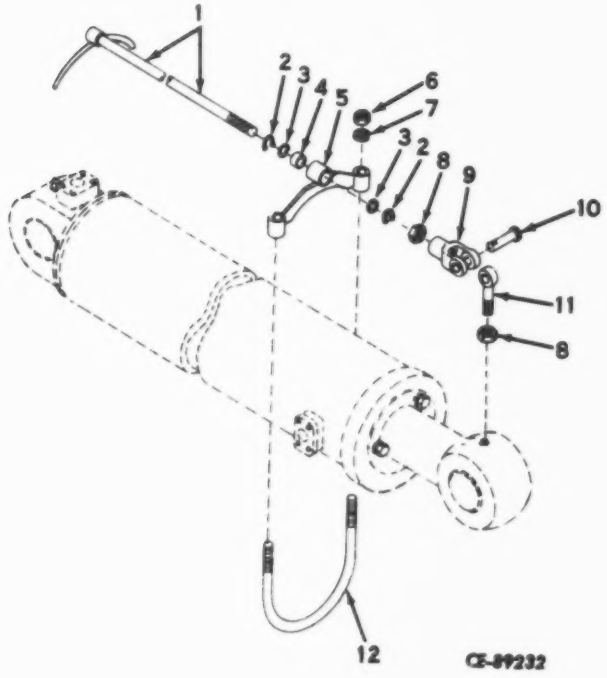
(*) - Part of CARTRIDGE KIT, 196 420 H4.
(#) - Part of SEAL KIT, 185 360 H1.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **STEERING PUMP – Continued** |
| | | **U001109 and up, also 01097** |
| | | **C001127 and up** |
| 21 | 165 003 H1 | WASHER |
| 22 | 165 004 H1 | SEAL, primary (#) |
| 23 | 165 005 H1 | SEAL, secondary (#) |
| 24 | 164 373 H3 | BODY |
| | 196 420 H4 | KIT, cartridge (25 GPM) (Includes items 3 thru 16) |
| | 185 360 H1 | KIT, seal (Includes items 13 thru 16 also 22 and 23) |

(*) - Part of CARTRIDGE KIT, 196 420 H4.
(#) - Part of SEAL KIT, 185 360 H1.

MEMORANDA

BUCKET POSITION INDICATOR




Parts without letters after the description indicates the part is used for all Bucket Position Indicators listed below; Letters A and B are used to identify separate Bucket Position Indicators

A — Service Parts for Bucket Position Indicator
U001108 and down except 01097
C001126 and below

B — Service Parts for Bucket Position Indicator
U001109 and up also 01097
C001127 and up

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 884 193 C1 | INDICATOR |
| 2 | 21 225 R1 | RING, retaining (2) |
| 3 | 173 862 H1 | WASHER (2) |
| 4 | 171 912 H1 | BUSHING |
| 5 | 199 203 H1 | GUIDE (Bucket Position A) (Composed of<br>1 BUSHING 171 912 H1<br>§ 1 CLAMP<br>2 RING, RETAINING 21 225 R1<br>2 WASHER 173 862 H1) |
| 5 | 213 147 H1 | GUIDE (Bucket Position B) (Composed of<br>1 BUSHING 171 912 H1<br>§ 1 CLAMP<br>2 RING, RETAINING 21 225 R1<br>2 WASHER 173 862 H1) |
| 6 | 18 452 R1 | NUT, 1/2NF (2) |
| 7 | 106 265 | WASHER, 1/2" lock (2) |
| 8 | 114 498 | NUT, 5/8NF jam (2) |
| 9 | 127 786 | YOKE |
| 10 | 114 788 | CLEVIS |
| | 103 387 | PIN, clevis |
| 11 | 197 484 H1 | EYE, bolt |
| 12 | 199 206 H1 | "U" BOLT (Bucket Position A) |
| 12 | 213 150 H1 | "U" BOLT (Bucket Position B) |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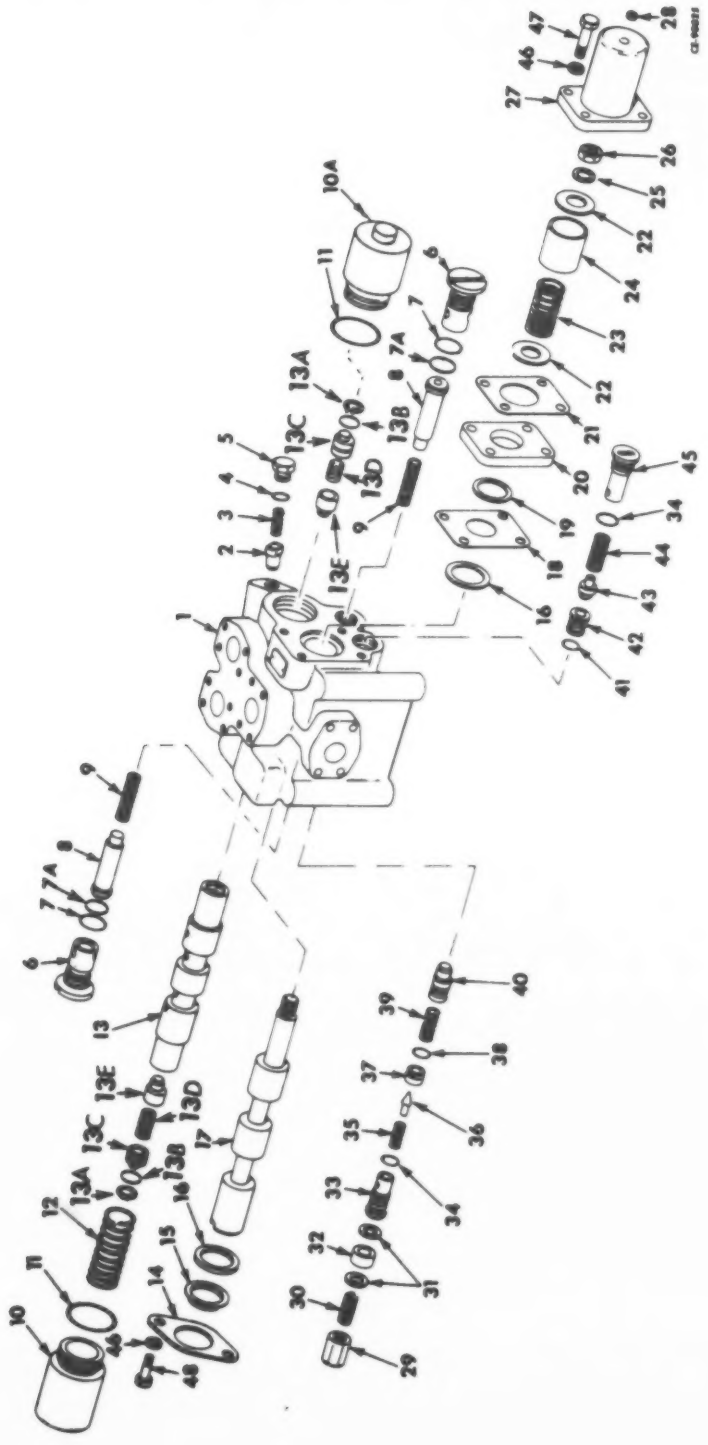
STEERING VALVE





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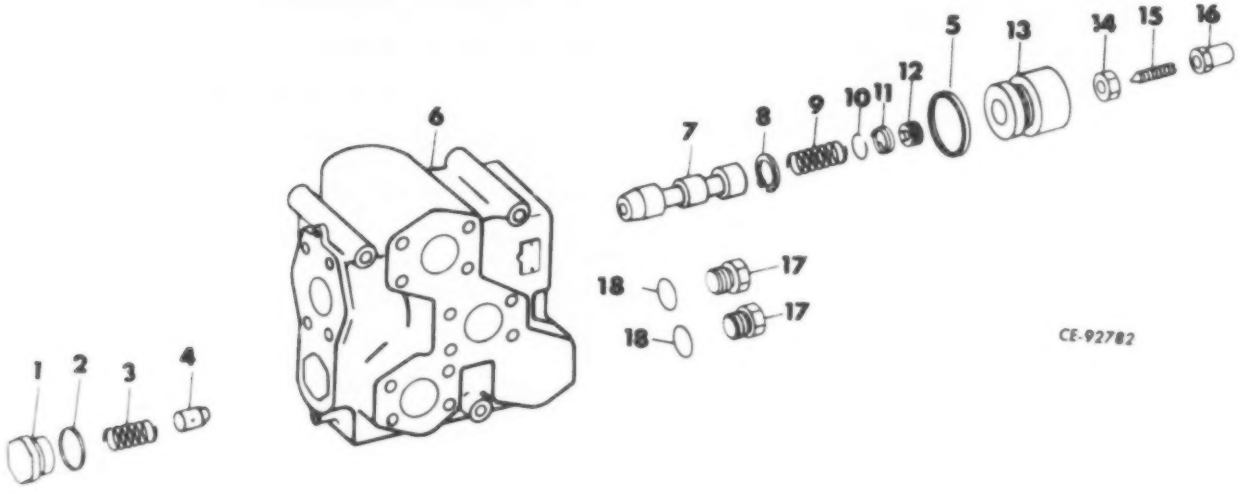
STEERING VALVE - Continued

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 884 024 C92 | VALVE, steering |
| | 25 687 R1 | BOLT (3) |
| | 25 526 R1 | NUT (3) |
| | 25 536 R1 | WASHER, 1/2" flat (6) |
| | 117 124 H1 | WASHER, 1-1/4" O.D. flat (x) |
| | | (Consists of the following parts - |
| 1 | | HOUSING, valve (Not Furnished Separately) |
| 2 | 892 510 C1 | CHECK |
| 3 | 876 138 C1 | SPRING |
| 4 | 21 254 R1 | RING, square |
| 5 | 881 776 C1 | CAP |
| 6 | 881 779 C1 | SEAT, relief (2) |
| 7 | 22 462 R1 | RING, square (2) |
| 7A | 376 769 R1 | "O" RING (2) |
| 8 | 881 782 C91 | RELIEF VALVE (2) |
| 9 | 884 753 C1 | SPRING (2) |
| 10 | 881 786 C1 | CAP |
| 10A | 884 585 C1 | CAP |
| 11 | 22 463 R1 | RING, square (2) |
| 12 | 882 122 C1 | SPRING, lock |
| 13 | | PLUNGER (Not Furnished Separately) |
| 13A | 238 627 R1 | RING, retaining (2) |
| 13B | 350 667 R1 | "O" RING (2) |
| 13C | 884 748 C1 | PLUG (2) |
| 13D | 884 776 C1 | SPRING (200 P.S.I.) (2) |
| 13E | 882 106 C1 | CHECK (2) |
| 14 | 881 789 C1 | WIPER |
| 15 | 881 793 C1 | WIPER |
| 16 | 876 144 C1 | SEAL (2) |
| 17 | | PLUNGER (Not Furnished Separately) |
| 18 | | SHIM (Not Furnished Separately) |
| 19 | 321 833 R1 | RING, back-up |
| 20 | 881 790 C1 | SPACER |
| 21 | | SHIM (Not Furnished Separately) |
| 22 | 881 777 C1 | SPACER (2) |
| 23 | 881 842 C1 | SPRING |
| 24 | 881 778 C1 | SPACER |
| 25 | 884 855 C1 | WASHER |
| 26 | 219 753 | NUT, 3/4 - 16 jam |
| 27 | 881 791 C1 | COVER |
| 28 | 606 276 C1 | PLUG, bleeder |
| 29 | 882 095 C1 | NUT, acorn |
| 30 | 881 792 C1 | SCREW, adjustment |
| 31 | 171 480 H1 | WASHER (2) |
| 32 | 114 496 | NUT, 1/2"NF, jam |
| 33 | 881 788 C1 | CAP |
| 34 | 350 684 R1 | "O" RING (Replaces 306 358 R1) |
| 35 | 171 482 H1 | SPRING |
| 36 | 181 072 H1 | POPPET |
| 37 | 881 780 C1 | SEAT, relief |
| 38 | 350 429 R1 | "O" RING (Replaces 321 956 R1) |
| 39 | 395 833 R1 | SPRING |
| 40 | 884 586 C1 | CHECK |
| 41 | 324 164 R1 | "O" RING (On units so equipped) |
| 42 | 881 781 C2 | SEAT, relief |
| 43 | 882 520 C1 | CHECK |
| 44 | 881 758 C1 | SPRING |
| 45 | 881 787 C1 | CAP |
| 46 | 103 321 | WASHER, 3/8" lock (6) |
| 47 | 179 843 | BOLT, 3/8NC x 1-1/2" (4) |
| 48 | 179 838 | BOLT, 3/8NC x 7/8" (2) |

(x) - As Required.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

DEMAND VALVE (DV 16A 3G)




Parts without letters after the description indicate the part is used for all Demand Valves listed below; Letters A and B are used to identify separate Demand Valves

| | | |
|---|---|---|
| A | 884 023 C91 | VALVE, demand (Order VALVE, 893 336 C92) U001108 and down except 01097 C001126 and below |
| B | 893 336 C91 | VALVE, demand (DV 16A 3G) (Order VALVE, 893 336 C92) U001109 and up also 01097 C001127 and up (Consists of the following |
| 1 | 886 377 C1 | CAP |
| 2 | 23 087 R1 | RING, square |
| 3 | 886 576 C1 | SPRING |
| 4 | 606 977 C1 | CHECK |
| 5 | 23 502 R1 | RING, sealing - square |
| 6 | | HOUSING (Not Furnished Separately) |
| 7 | | PLUNGER (Not Furnished Separately) |
| 8 | 886 378 C1 | RING, retaining |
| 9 | 894 542 C1 | SPRING (Demand Valve B) |
| 10 | 253 070 R1 | "O" RING |
| 11 | 886 383 C1 | RING, back-up |
| 12 | 886 375 C1 | SPRING, guide |
| 13 | 886 376 C1 | CAP |
| 14 | 114 496 | NUT, 1/2NF jam |
| 15 | 21 153 R1 | SCREW, adjusting |
| 16 | 875 787 C1 | NUT, acorn |
| 17 | 886 423 C1 | CAP (2) |
| 18 | 875 548 C1 | "O" RING (2) |



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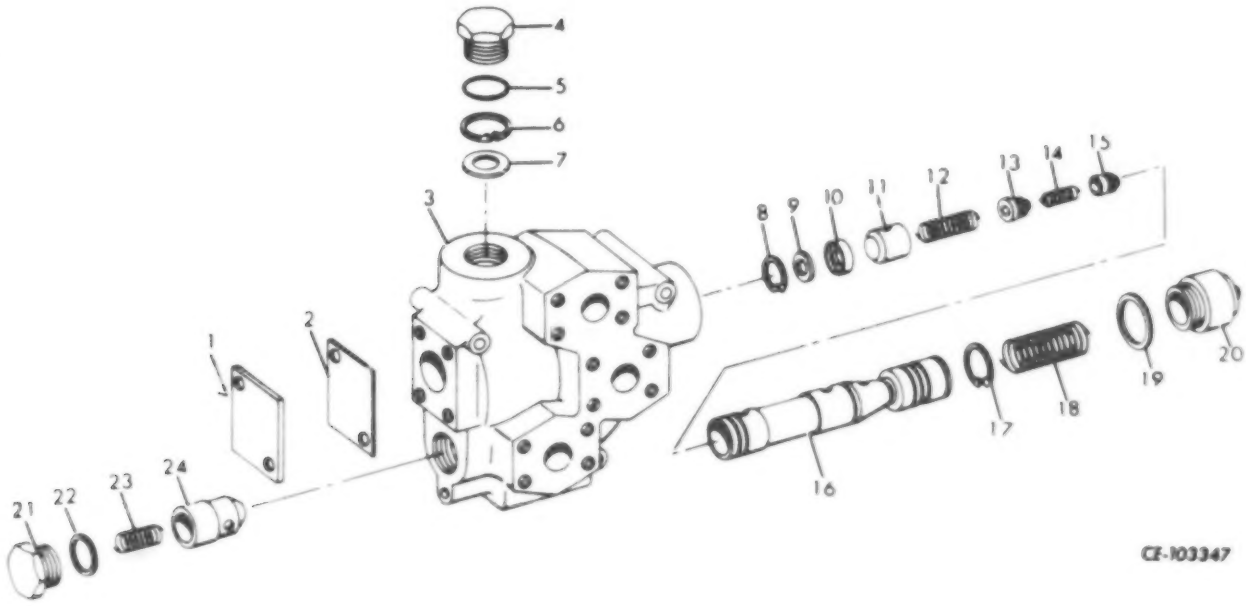
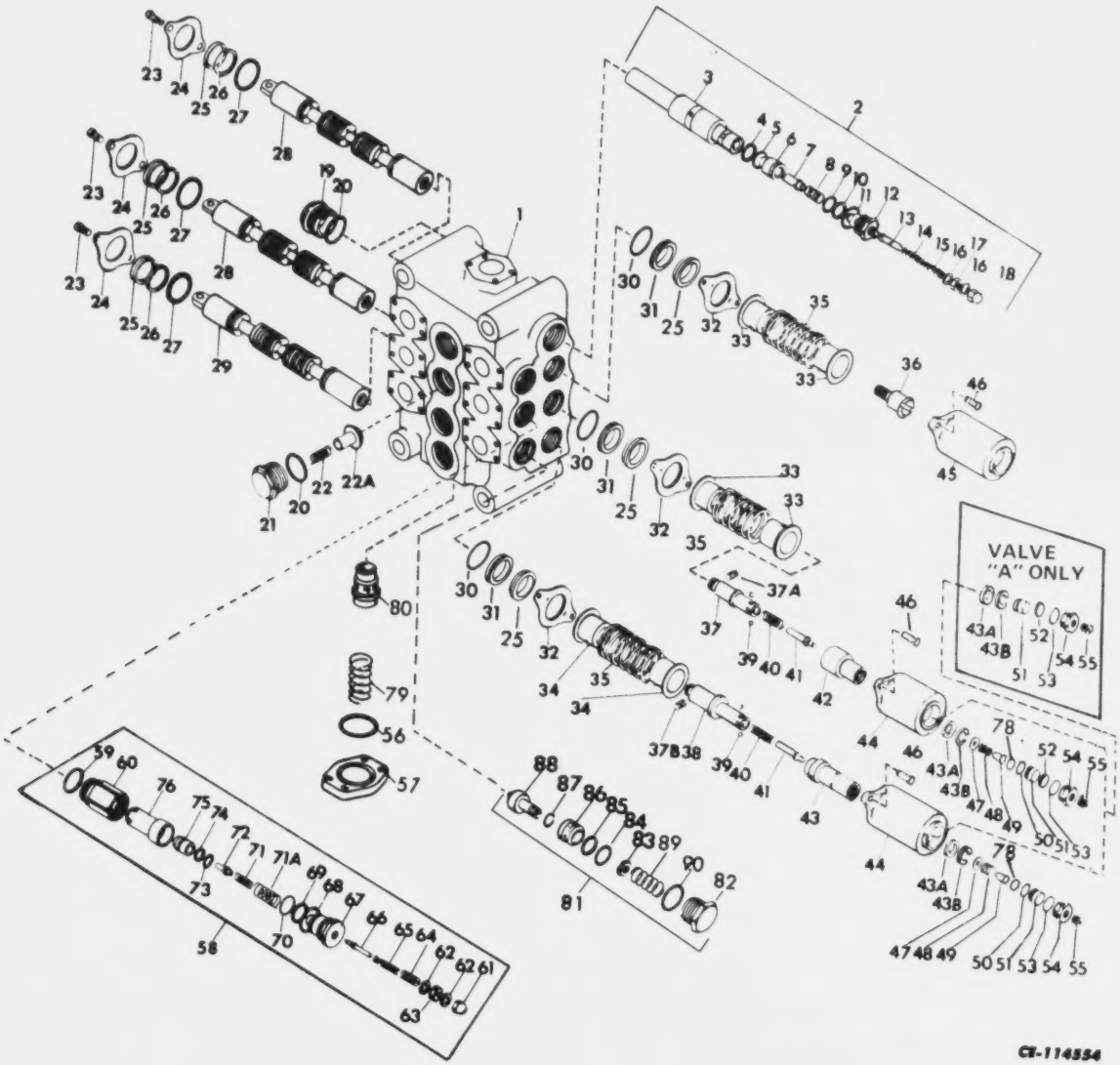
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## DEMAND VALVE (DV 20B 2A)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 893 336 C92 | VALVE, demand (DV 20B 2A) U001109 and up also 01097 C001127 and up |
| | 24 888 R1 | SCREW, hex-hd cap (2) |
| | 25 548 R1 | WASHER, flat (2) |
| | | (Consists of the following parts |
| 1 | 923 753 C1 | PLATE |
| | 179 879 | BOLT, 1/2NC x 3/4" |
| 2 | 923 752 C1 | GASKET |
| 3 | | BODY (Not furnished separately) |
| 4 | 9 410 364 | CAP |
| 5 | 307 915 R1 | RING, seal |
| 6 | 346 731 R1 | RING, retaining |
| 7 | 923 821 C1 | PLUG, orifice |
| 8 | 299 470 R1 | RING, retaining |
| 9 | 924 192 C1 | PLUG, orifice |
| 10 | 923 751 C1 | CHECK, seat |
| 11 | 923 747 C1 | CHECK |
| 12 | 619 047 C1 | SPRING |
| 13 | 923 750 C1 | CAP |
| 14 | 923 754 C1 | SPRING |
| 15 | 923 746 C1 | CHECK |
| 16 | | PLUNGER (Not furnished separately) |
| 17 | 25 618 R1 | RING, retaining |
| 18 | 923 755 C1 | SPRING |
| 19 | 23 502 R1 | RING, seal |
| 20 | 923 749 C1 | CAP |
| 21 | 886 377 C1 | CAP |
| 22 | 23 087 R1 | RING, seal |
| 23 | 886 576 C1 | SPRING |
| 24 | 606 977 C1 | CHECK |

MAIN CONTROL VALVE
(3 Spool)



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| MAIN CONTROL VALVE – Continued (3 Spool) | | |
| | | Parts without letters after the description indicate the part is used for all valves listed below: Letters A and B are used to identify separate valves. |
| A | 875 227 C93 | VALVE ASSEMBLY, main control (3 Spool) (4753-2G) (Order VALVE ASSY, 875 227 C95) |
| B | 875 227 C95 | VALVE ASSEMBLY, main control (3 Spool) (47538B) |
| 1 | | HOUSING (Not furnished separately) |
| 2 | 894 848 C91 | CARTRIDGE ASSY, relief valve (Valve A) |
| 2 | 942 700 C91 | CARTRIDGE ASSY, relief valve (Valve B) |
| 3 | 894 849 C1 | SLEEVE |
| 4 | 875 718 C2 | RING, back-up |
| 5 | 876 065 C1 | "O" RING |
| 6 | 875 709 C1 | POPPET |
| 7 | 208 940 H1 | PISTON (Valve A) |
| 7 | 942 531 C1 | PISTON |
| 8 | 208 937 H1 | SPRING |
| 9 | 876 065 C1 | "O" RING |
| 10 | 875 718 C2 | RING, back-up |
| 11 | 876 111 C1 | "O" RING |
| 12 | 875 719 C1 | PLUG |
| 13 | 208 939 H1 | POPPET |
| 14 | 208 941 H1 | SPRING |
| 15 | 208 942 H1 | SCREW, adjusting (Valve A) |
| 15 | 942 528 C1 | SCREW, adjusting (Valve B) |
| 16 | 208 943 H1 | WASHER (2) |
| 17 | 208 944 H1 | NUT |
| 18 | 208 945 H1 | NUT, acorn |
| 19 | 156 801 H1 | PLUG |
| 20 | 876 111 C1 | "O" RING (5) |
| 21 | 156 812 H2 | PLUG (4) |
| 22 | 156 813 H1 | SPRING (4) |
| 22A | 156 814 H1 | POPPET (4) |
| 23 | 24 927 R1 | SCREW, machine (6) |
| 24 | 156 821 H1 | PLATE, seal (Valve A) (3) |
| 24 | 942 693 C1 | PLATE, seal (Valve B) (3) |
| 25 | 942 695 C1 | WIPER (6) |
| 26 | 942 694 C1 | SEAL (3) |
| 27 | 212 955 H1 | "O" RING (Valve A) (3) |
| 28 | | PLUNGER (Not furnished separately) (2) |
| 29 | | PLUNGER (Not furnished separately) |
| 30 | 212 955 H1 | "O" RING (Valve A) (3) |
| 31 | 942 694 C1 | SEAL (3) |
| 32 | 156 821 H1 | PLATE, seal (Valve A) (3) |
| 32 | 942 693 C1 | PLATE, seal (Valve B) (3) |
| 33 | 192 688 H1 | SPRING, seat (4) |
| 34 | 165 794 H1 | GUIDE, spring (2) |
| 35 | 192 689 H1 | SPRING, plunger (3) |
| 36 | 208 089 H1 | BOLT, special |
| 37 | 192 691 H1 | PIN, plunger |
| 38 | 192 697 H1 | PIN, plunger |
| 39 | 16 008 R1 | BALL (6) |
| 40 | 192 693 H1 | SPRING (2) |
| 41 | 214 492 H2 | CAM (2) |
| 42 | 214 493 H1 | SLEEVE |
| 43 | 214 492 H1 | SLEEVE |
| 43A | 214 495 H1 | SPACER (2) |
| 43B | 214 494 H1 | RING, snap (2) |
| 44 | 214 490 H1 | CAP, plunger (2) |
| 45 | 208 088 H1 | CAP, plunger |
| 46 | 380 286 R1 | BOLT (6) |
| 47 | 934 691 C1 | WASHER (Valve B) (2) |
| 48 | 878 221 C1 | SPRING (Valve B) |
| 49 | 878 223 C1 | PIN, guide (Valve B) (2) |
| 50 | 881 132 C1 | "O" RING (Valve B) (2) |
| 51 | 205 565 H1 | PISTON (Valve A) (2) |
| 51 | 934 692 C1 | PISTON (Valve B) (2) |
| 52 | 192 699 H1 | SPACER |
| 53 | 876 108 C1 | "O" RING (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| MAIN CONTROL VALVE – Continued (3 Spool) | | |
| 54 | 192 686 H1 | PLUG (Valve A) (2) |
| 54 | 878 224 C1 | PLUG (Valve B) (2) |
| 55 | 444 691 | PLUG, 1/4" pipe (2) |
| 56 | 876 077 C1 | "O" RING |
| 57 | 176 197 H1<br>380 286 R1 | PLATE<br>BOLT (4) |
| 58 | 216 971 H1 | CYLINDER, relief valve (Valve A) (4) |
| 58 | 942 699 C91 | CYLINDER, relief valve (Valve B) (4) |
| 59 | 876 111 C1 | "O" RING (4) |
| 60 | 208 938 H1 | CAP (4) |
| 61 | 208 945 H1 | NUT' acorn (4) |
| 62 | 208 943 H1 | WASHER (8) |
| 63 | 208 944 H1 | NUT (4) |
| 64 | 208 942 H1 | SCREW, adjusting (Valve A) (4) |
| 64 | 942 528 C1 | SCREW, adjusting (Valve B) (4) |
| 65 | 208 941 H1 | SPRING (4) |
| 66 | 208 939 H1 | POPPET (4) |
| 67 | 208 948 H1 | PLUG (4) |
| 68 | 876 111 C1 | "O" RING (4) |
| 69 | 1 130 737 C1 | RING, back-up (4) |
| 70 | 876 070 C1 | "O" RING (4) |
| 71 | 208 937 H1 | SPRING (4) |
| 71A | 212 502 H1 | SPRING (4) |
| 72 | 208 940 H1 | PISTON (Valve A) (4) |
| 72 | 942 531 C1 | PISTON (Valve B) (4) |
| 73 | 876 068 C1 | "O" RING (4) |
| 74 | 1 130 739 C1 | RING, back-up (4) |
| 75 | 208 947 H1 | POPPET (4) |
| 76 | 208 949 H1 | POPPET (Valve A) (4) |
| 76 | 942 698 C1 | POPPET (Valve B) (4) |
| 77 | 214 496 H1 | INSERT (2) |
| 78 | 934 694 C1 | RING, back-up (Valve B) |
| 79 | 883 168 C1 | SPRING |
| 80 | 883 166 C1 | POPPET |
| 81 | 208 561 H2 | VOID CONTROL ASSEMBLY (2) |
| 82 | 208 934 H1 | PLUG (2) |
| 83 | 17 296 R1 | NUT (2) |
| 84 | 876 070 C1 | "O" RING (2) |
| 85 | 208 933 H2 | RING, back-up (2) |
| 86 | 212 498 H1 | SPACER (2) |
| 87 | 876 066 C1 | "O" RING (2) |
| 88 | 212 499 H1 | POPPET (2) |
| 89 | 212 501 H1 | SPRING (2) |
| 90 | 876 111 C1 | "O" RING (2) |


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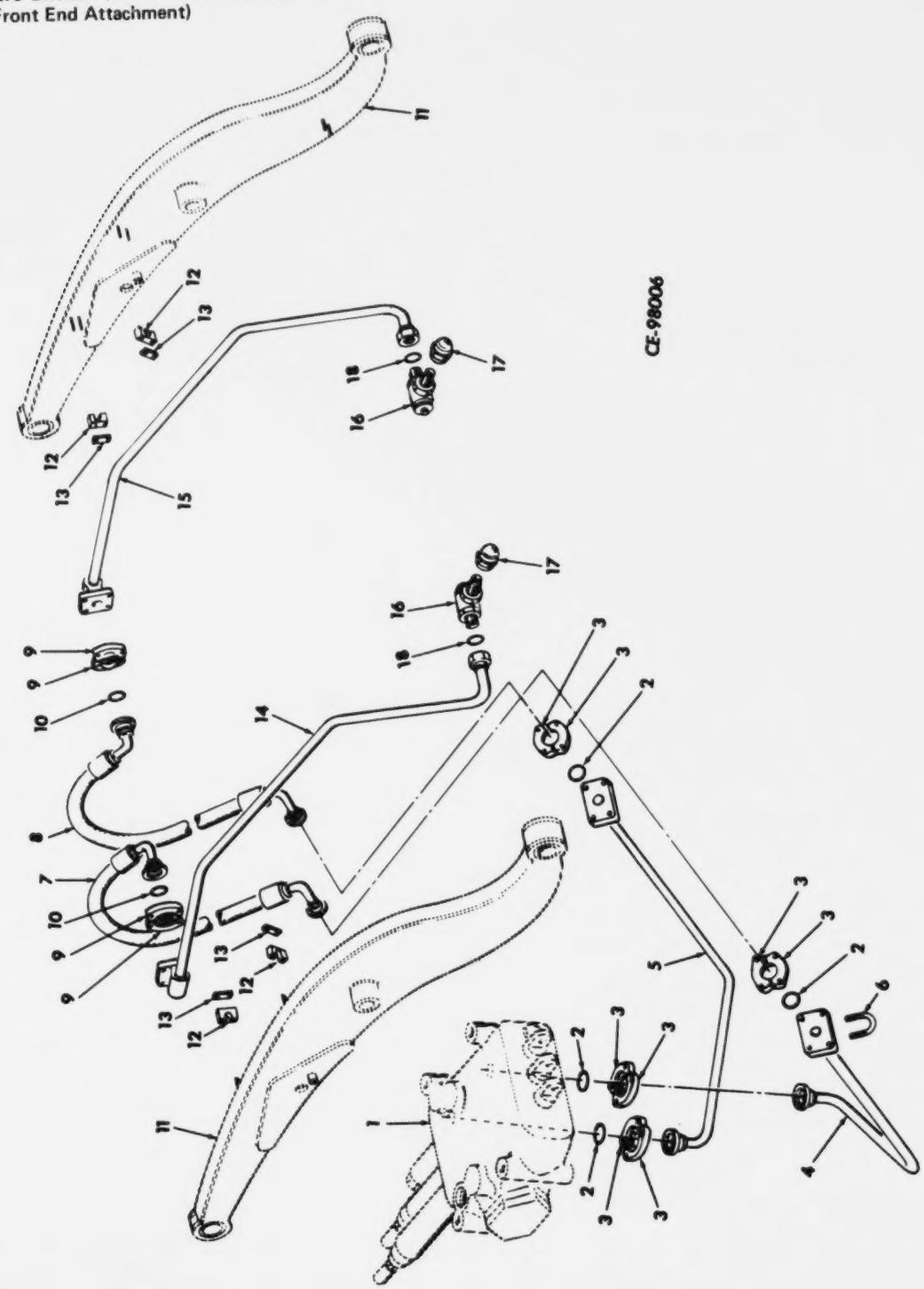
HYDRAULIC LINES - (For Machines equipped with hydraulic Front End Attachment)



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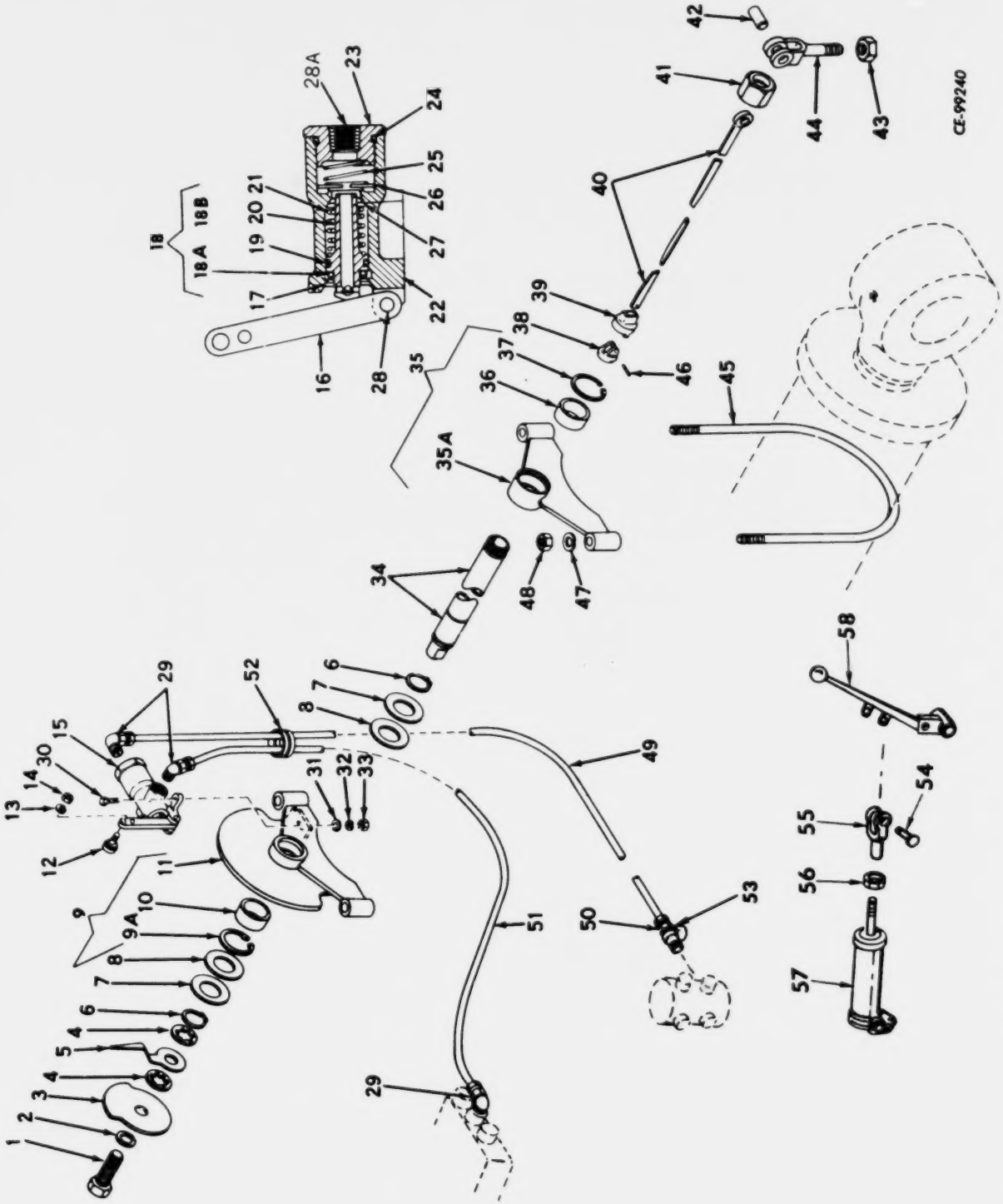
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **HYDRAULIC LINES - (For Machines equipped with hydraulic Front End Attachment) - Continued** |
| 1 | | Valve (See 3 Spool Valve in this Section) |
| 2 | 876 072 C1 | "O" RING (4) |
| 3 | 290 045 R1 | FLANGE, split (8) |
| | 179 860 | BOLT, 7/16NC x 1-1/4" (16) |
| 4 | 888 776 C2 | TUBE L.H. |
| 5 | 888 775 C1 | TUBE R.H. |
| 6 | 153 676 H1 | "U" BOLT |
| | 106 263 | WASHER, 3/8 flat (2) |
| | 18 423 R1 | NUT, 3/8-16NC Esna (2) |
| 7 | 888 764 C1 | HOSE L.H. |
| 8 | 888 765 C1 | HOSE R.H. |
| 9 | 877 949 C2 | FLANGE, split (4) |
| | 179 841 | BOLT, 3/8NC x 1-1/4" (8) |
| 10 | 876 071 C1 | "O" RING (2) |
| 11 | | BOOM (See Section 17) (2) |
| 12 | 183 692 H1 | CLAMP (10) |
| | 18 423 R1 | NUT, 3/8-16NC Esna (12) |
| 13 | 183 693 H1 | PLATE, top (4) |
| 14 | 888 774 C2 | TUBE R.H. |
| 15 | 888 773 C2 | TUBE L.H. |
| 16 | 9 410 207 | SWIVEL (2) |
| 17 | 166 897 H1 | NUT, cap (2) |
| 18 | 876 110 C1 | "O" RING (2) |

BUCKET LEVELER AND POSITION INDICATOR KIT



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **BUCKET LEVELER AND POSITION INDICATOR KIT - Continued** | | |
| | 888 982 C91 | KIT, bucket leveler and position indicator (See Note)<br>U001108 and below except 01097<br>C001126 and below |
| | 895 997 C91 | KIT, bucket leveler and position indicator (See Note)<br>U001109 and up also 01097<br>C001127 and up<br>(Consists of the following parts - |
| 1 | 271 583 | SCREW, cap |
| 2 | 103 325 | WASHER, lock |
| 3 | 206 328 H1 | CAM |
| 4 | 158 282 H1 | WASHER, lock (2) |
| 5 | 206 329 H1 | INDICATOR |
| 6 | 206 320 H1 | RING, retaining (2) |
| 7 | 206 330 H1 | WASHER, thrust (2) |
| 8 | 206 331 H1 | WASHER, thrust (2) |
| 9 | 882 287 C11 | GUIDE ASSEMBLY, rear<br>U001108 and below except 01097<br>C001126 and below |
| 9 | 895 999 C91 | GUIDE ASSEMLBY, rear<br>U001109 and up also 01097<br>C001127 and up |
| 9A | 206 321 H1 | RING |
| 10 | 206 319 H1 | BUSHING |
| 11 | 882 287 C1 | BRACKET<br>U001108 and below except 01097<br>C001126 and below |
| 11 | 895 999 C91 | BRACKET<br>U001109 and up also 01097<br>C001127 and up |
| 12 | 210 917 H1 | FOLLOWER w/BUSHING 210 918 H1 |
| 13 | 103 319 | WASHER, lock 1/4" |
| 14 | 103 324 | NUT, hex 1/4NF |
| 15 | 923 051 C91 | VALVE, control (Includes items 17 thru 26, 28 and 28A) |
| 16 | 882 289 C1 | BAR (Not part of CONTROL VALVE 923 051 C91) |
| 17 | 373 173 R1 | RING, retaining |
| 18 | 188 572 H1 | SEAL, plunger |
| 18A | 188 573 H1 | BODY, plunger seal |
| 18B | 188 574 H1 | WASHER, felt |
| 19 | 878 206 C1 | GROMMET, plunger |
| 20 | 188 571 H1 | PLUNGER |
| 21 | 188 570 H1 | SPRING |
| 22 | 878 921 C1 | BODY |
| 23 | 188 568 H1 | CAP |
| 24 | 924 383 C1 | "O" RING |
| 25 | 188 565 H1 | SPRING |
| 26 | 188 564 H1 | VALVE |
| 27 | 188 569 H1 | WASHER |
| 28 | 188 576 H1 | PIN |
| 28A | 180 140 H1 | PLUG, pipe (Special) |
| 29 | 206 407 H1 | COUPLING, 90° (3) |
| 30 | 181 314 | SCREW, cap 1/4NF x 7/8" (2) |
| 31 | 103 261 | WASHER, flat 1/4" (2) |
| 32 | 103 319 | WASHER, lock 1/4" (2) |
| 33 | 103 024 | NUT, 1/4NF hex (2) |
| 34 | 883 016 C1 | TUBE |
| 35 | 207 499 H1 | BRACKET ASSEMBLY, front<br>U001108 and below except 01097<br>C001126 and below |
| 35 | 213 456 H1 | BRACKET ASSEMBLY, front<br>U001109 and up also 01097<br>C001127 and up |
| 35A | | BRACKET (Not Furnished Separately) |
| 36 | 206 319 H1 | BUSHING |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

BUCKET LEVELER AND POSITION INDICATOR KIT - Continued

| | | |
|---|---|---|
| 37 | 206 321 H1 | RING, retaining |
| 38 | 206 326 H1 | PLUNGER |
| 39 | 206 327 H1 | WIPER |
| 40 | 888 983 C1 | SLIDE |
| 41 | 9 403 532 | NUT, tube |
| 42 | 114 788 | PIN, clevis |
| 43 | 114 498 | NUT, jam 5/8NF (2) |
| 44 | 206 325 H1 | CLEVIS, rod end |
| 45 | 207 527 H1 | BOLT, "U" (2)<br>U001108 and below except 01097<br>C001126 and below |
| 45 | 213 150 H1 | BOLT, "U" (2)<br>U001109 and up also 01097<br>C001126 and up |
| 46 | 17 283 R1 | PIN, spring |
| 47 | 106 265 | WASHER, flat 1/2" (4) |
| 48 | 18 452 R1 | NUT, Esna 1/2-20NF (4) |
| 49 | 206 409 H1 | HOSE, R.H. Brake Valve to Control Valve |
| 50 | 206 406 H1 | COUPLING, straight |
| 51 | 206 408 H1 | HOSE |
| 52 | 610 213 C91 | STRAP, Air Hoses to Bucket Cylinder Hose (2) |
| 53 | 444 256 | TEE |
| 54 | 114 785 | PIN |
| 55 | 104 038 | YOKE |
| 56 | 114 494 | NUT, jam |
| 57 | 896 206 C1 | ABSORBER, air shock |
| | 153 138 | SCREW, No. 8 NC x 1/2" machine (3) |
| | 453 996 | NUT, No. 8 NC (3) |
| 58 | | LEVER, bucket (See Valve Control Linkage in this Section) |
| | 210 918 H1 | BUSHING (part of CAM, 210 917 H1) |
| | 219 038 H1 | INSTALLATION DRAWING |



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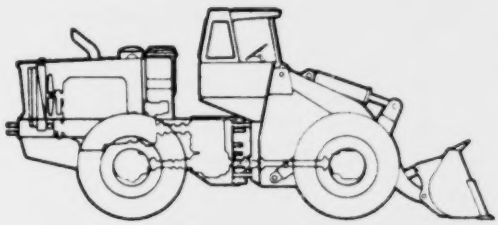
# SECTION 11

# INSTRUMENTS



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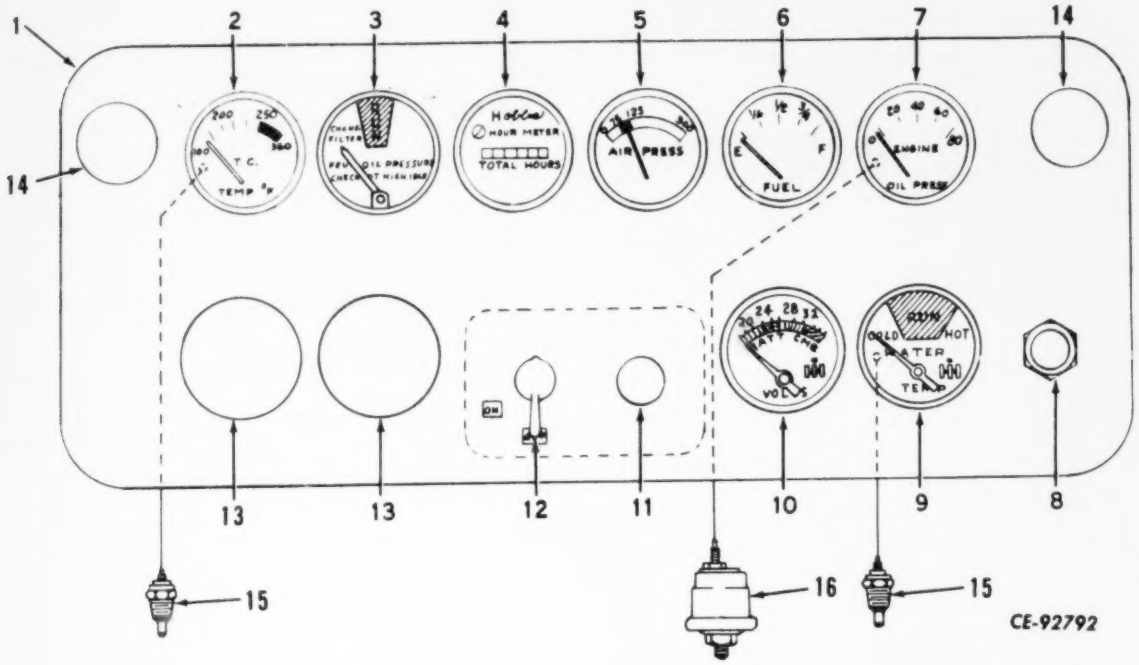
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## INSTRUMENTS AND RELATED PARTS (I.H.)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | PANEL, instrument (See Instrument Panel in this Section) |
| 2 | 885 367 C1 | PACKAGE, torque converter gauge (Consists of<br>2 NUT 134 530<br>2 LOCKWASHER 131 044<br>2 NUT 120 614<br>2 LOCKWASHER 120 217<br>§ 1 GAUGE |
| 3 | 663 407 C1 | GAUGE, fuel pressure |
| 4 | 921 750 C91 | HOURMETER<br>U001187 and below<br>C001195 and below |
| 4 | 432 580 | PLUG, button<br>U001188 and up<br>C001196 and up |
| 5 | 885 306 C1 | PACKAGE, air pressure gauge (Consists of<br>§ 1 GAUGE<br>2 NUT 120 614<br>2 LOCKWASHER 120 217) |
| | 120 614 | NUT, No. 10-32 NF (2) |
| | 120 217 | WASHER No. 10 lock (2) |
| 6 | 885 369 C1 | PACKAGE, fuel gauge (Consists of<br>§ 1 GAUGE<br>2 NUT 134 530<br>2 LOCK-WASHER 131 044<br>2 NUT 120 614<br>2 LOCK-WASHER 120 217 ) |
| 7 | 885 366 C2 | PACKAGE, engine oil pressure gauge (Consists of<br>§ 1 GAUGE<br>2 NUT 134 530<br>2 LOCK-WASHER 131 044<br>2 NUT 120 614<br>2 LOCK-WASHER 120 217 ) |
| 8 | | SWITCH (See Wiring in Section 8) |

§ - Not Furnished Separately.



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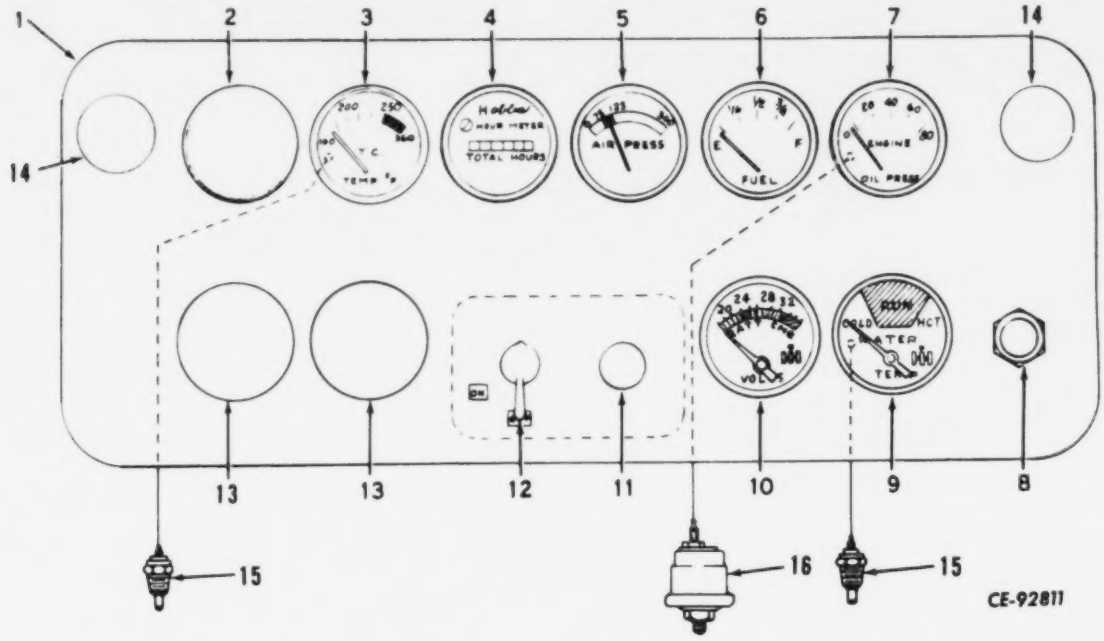
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**INSTRUMENTS AND RELATED PARTS (I.H.) - Continued**

| | | |
|---|---|---|
| 9 | 885 368 C1 | PACKAGE, engine temperature gauge (Consists of -<br>§ 1 GAUGE<br>2 NUT 134 530<br>2 LOCK-WASHER 131 044<br>2 NUT 120 614<br>2 LOCK-WASHER 120 217 |
| 10 | 886 727 C1 | VOLTMETER |
| | 134 530 | No. 6 - 32NF NUT (3) |
| | 131 044 | No. 6 lock WASHER (3) |
| | 120 614 | No. 10 - 32NF NUT |
| | 120 217 | No. 10 lock WASHER |
| 11 | | SWITCH, light (See Wiring in Section 8) |
| 12 | | SWITCH, ignition (See Wiring in Section 8) |
| 13 | 432 580 | PLUG, button (3) |
| 14 | | LIGHT, dash (See Lighting in Section 8) |
| 14 | 142 020 | PLUG, button (Used on units equipped with back lighting for air core gauges) (2) |
| 15 | 136 798 H1 | SENDER, torque converter temperature and water temperature (2) |
| 16 | 884 564 C2 | SENDER, engine oil pressure |
| | 134 530 | NUT, No. 6-32 NF (10) |
| | 131 044 | WASHER, No. 6 lock (10) |
| | 120 614 | NUT, No. 10-32NF (10) |
| | 120 217 | WASHER, No. 10 lock (10) |

§ - Not Furnished Separately.

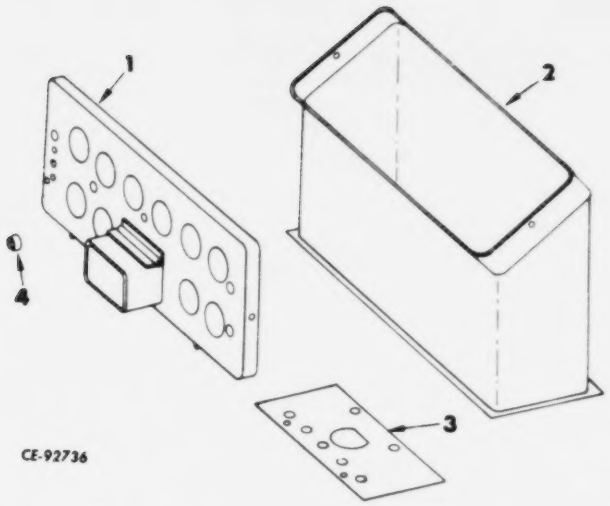
INSTRUMENTS AND RELATED PARTS (Cummins)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | PANEL, instrument (See Instrument Panel in this Section) |
| 2 | 432 580 | PLUG, button |
| 3 | 885 367 C1 | PACKAGE, torque converter gauge (Consists of - 2 NUT 134 530; 2 LOCKWASHER 131 044; 2 NUT 120 614; 2 LOCKWASHER 120 614; § 1 GAUGE ) |
| 4 | 921 750 C91 | HOURMETER (On units so equipped) |
| 4 | 432 580 | PLUG, button (Used on units not equipped with Hourmeter) |
| 5 | 885 306 C1 | PACKAGE, air pressure gauge (Consists of - § 1 GAUGE; 2 NUT 120 614; 2 LOCKWASHER 120 217 ) |
| | 120 614 | NUT # 10 - 32 NF (2) |
| | 120 217 | WASHER # 10 lock (2) |
| 6 | 885 369 C1 | PACKAGE, fuel gauge (Consists of - § 1 GAUGE; 2 NUT 134 530; 2 LOCKWASHER 131 044; 2 NUT 120 614; 2 LOCKWASHER 120 217 ) |
| 7 | 885 366 C2 | PACKAGE, engine oil pressure gauge (Consists of - § 1 GAUGE; 2 NUT 134 530; 2 LOCKWASHER 131 044; 2 NUT 120 614; 2 LOCKWASHER 120 217) |
| 8 | | SWITCH (See Wiring in Section 8) |
| 9 | 885 368 C1 | PACKAGE, engine temperature gauge (Consists of - § 1 GAUGE; 2 NUT 134 530; 2 LOCKWASHER 131 044; 2 NUT 120 614; 2 LOCKWASHER 120 217 |
| 10 | 886 728 C1 | VOLTMETER |
| 134 530 | | # 6 - 32 NF NUT (3) |
| 131 044 | | # 6 lock WASHER (3) |
| 120 614 | | # 10 - 32 NF NUT |
| 120 217 | | # 10 lock WASHER |
| 11 | | SWITCH, light (See Wiring in Section 8) |
| 12 | | SWITCH, ignition (See Wiring in Section 8) |
| 13 | 432 580 | PLUG, button (2) |
| 14 | | LIGHT, dash (See Lighting in Section 8) |
| 14 | 142 020 | PLUG, button (Used on units equipped with back lighting for air core gauge) (2) |
| 15 | 136 798 H1 | SENDER, torque converter temperature and water temperature (2) |
| 16 | 884 564 C2 | SENDER, engine oil pressure |
| 134 530 | | NUT, # 6 - 32 NF (10) |
| 131 044 | | WASHER, # 6 lock (10) |
| 120 614 | | NUT, # 10 - 32 NF (10) |
| 120 217 | | WASHER, # 10 lock (10) |

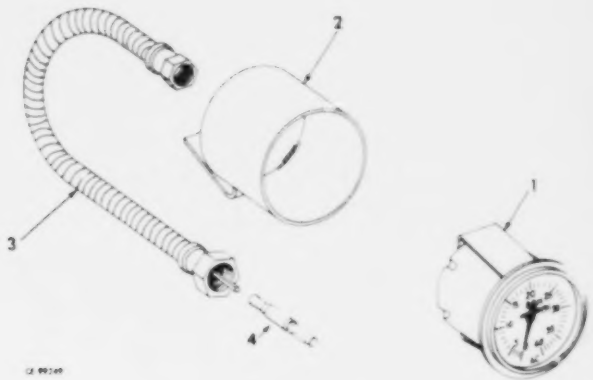
§ - Not Furnished Separately.

## INSTRUMENT PANEL, BOX AND RELATED PARTS




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 887 181 C1 | PANEL, instrument |
| | 181 307 | BOLT, 1/4NF x 3/8" (2) |
| | 120 380 | WASHER, 3/8 lock (2) |
| | 132 908 | SCREW, panel ground |
| | 120 217 | WASHER, lock No. 10 |
| | 120 614 | NUT, hex No. 10 - 32 |
| 2 | 887 182 C1 | BOX, instrument |
| | 25 772 R1 | BOLT, 3/8NF x 1/4" (4) |
| | 25 534 R1 | WASHER, 3/8" lock (4) |
| 3 | 887 180 C1 | SUPPORT |
| 4 | 153 619 H1 | BUMPER |

## TACHOMETER KIT



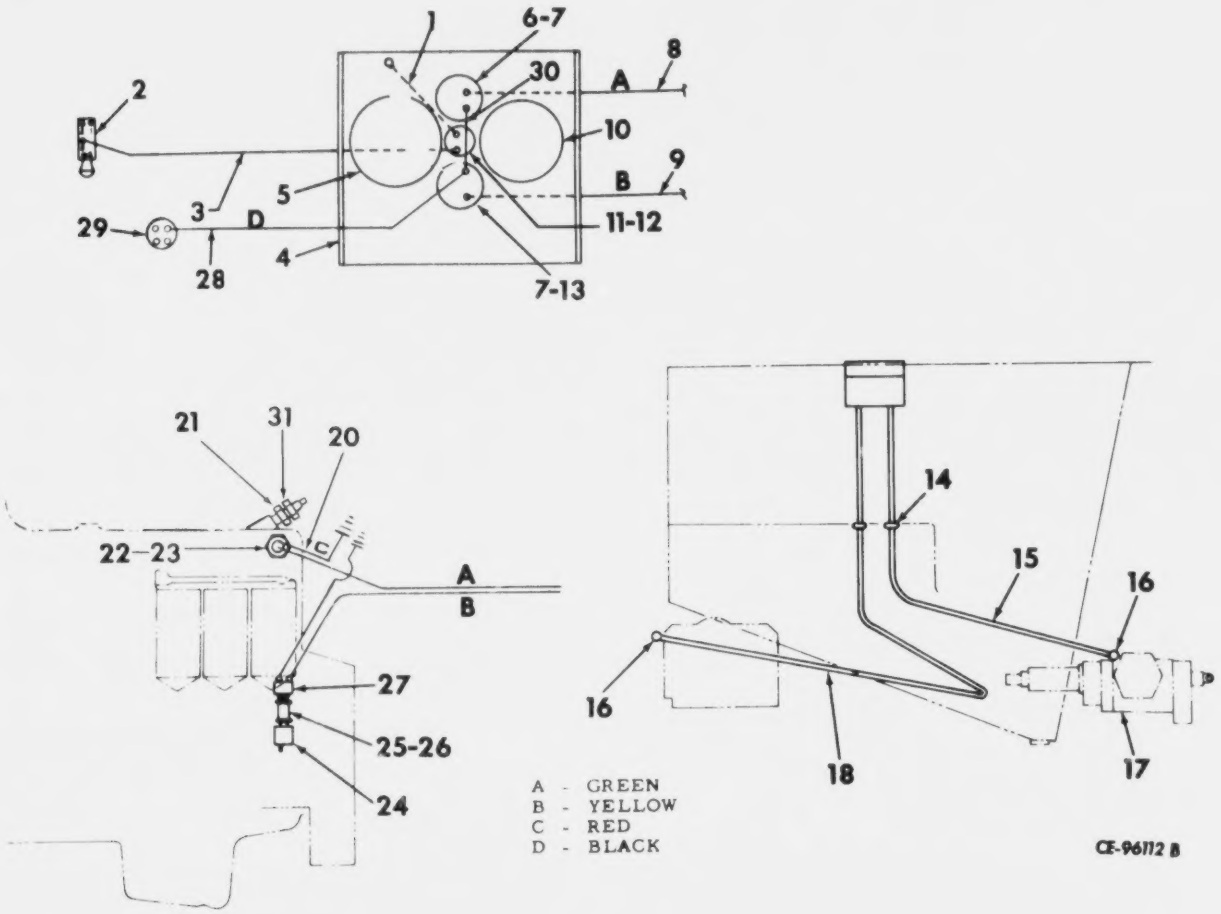

Parts without letters after the description indicate the part is used for all Tachometer Kits. Letter A and B are used to identify separate Tachometer Kits.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 891 069 C91 | KIT, tachometer (Cummins) (See Note 1) |
| B | 936 381 C91 | KIT, tachometer (I.H.)(See Note 1) |
| 1 | 876 686 C2 | |
| | 120 614 | NUT (2) |
| | 120 217 | WASHER, lock |
| 2 | 201 663 H1 | BRACKET (Used on units equipped when Tachometer is on side of Battery Box) |
| | 181 349 | BOLT (2) |
| | 103 320 | WASHER, lock (2) |
| | 103 025 | NUT (2) |
| 2 | 876 260 C1 | BRACKET (Used on units equipped with Tachometer at top of Hood) |
| | 25 493 R1 | BOLT (2) |
| | 25 533 R1 | WASHER (4) |
| | 9 413 977 | NUT (2) |
| 3 | 348 876 C91 | SHAFT, flex (Used on units equipped when Tachometer is on side of Battery Box) (Kit B) |
| 3 | 201 667 H1 | SHAFT, flex (Kit A) |
| 3 | 341 248 C91 | SHAFT, flex (Used on units equipped with Tachometer at top of hood) (Kit B) |
| 4 | 343 359 C1 | FLOATING TIP (Kit B) |
| | 140 582 | CLAMP, tachometer drive to engine (2) |
| | 140 580 | CLAMP (2) |
| | 177 904 H1 | SPACER, 3/8 O.D. x 1-1/2" |
| | FGH-11425 | DRAWING, installation |

Note 1: Order on Machine Order Form.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

AUXILIARY INSTRUMENTS




| | | Service parts for Auxiliary Instruments |
|---|---|---|
| 1 | 891 296 C1 | CABLE, light to ground |
| 2 | | SWITCH, light (See Section 8) |
| 3 | 891 297 C1 | CABLE, light to light |
| 4 | 891 303 C1 | SUPPORT |
| | 181 311 | SCREW, 1/4NF x 5/8" cap (2) |
| | 114 604 | WASHER, 1/4" lock (4) |
| | 103 024 | NUT, 1/4NF (2) |
| 5 | 205 495 H1 | GAUGE, hydraulic pressure |
| 6 | 891 301 C1 | LIGHT, water temperature |
| 7 | 24 551 R1 | BULB (24 volt) (2) |
| 8 | 923 705 C1 | CABLE, switch to light |
| 9 | 891 295 C1 | CABLE, sender to light |
| 10 | 188 328 H1 | GAUGE, transmission clutch pressure |
| 11 | 887 850 C1 | LIGHT, instrument |
| 12 | 454 732 | BULB (24 volt) |
| 13 | 891 302 C1 | LIGHT, oil pressure |
| 14 | 145 705 H1 | GROMMET (*) (2) |
| 15 | 891 298 C1 | HOSE (*) |
| 16 | 891 300 C1 | SOCKET (*) (2) |
| 17 | | VALVE, main control (See Section 10) |
| 18 | 891 299 C1 | HOSE (*) |
| 19 | 211 133 H1 | CABLE, sender to battery |

(*) - Also Listed and Illustrated in Section 7 and 10.



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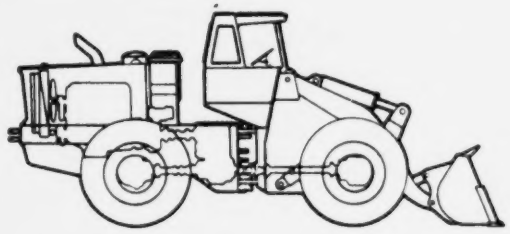
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **AUXILIARY INSTRUMENTS - Continued** | | |
| 20 | 923 707 C1 | CABLE, switch to ground |
| 21 | 120 062 | BUSHING, sender |
| 22 | 923 708 C1 | SWITCH, temperature (Together with CABLE, 923 707 C1 and CABLE 923 705 C1 will work for SENDER 891 325 C1) (See NOTE) |
| 23 | 144 046 | ADAPTER |
| 24 | | SENDER, engine oil pressure (See Instruments and Related Parts in this Section) |
| 25 | 105 416 | TEE |
| 26 | 105 404 | NIPPLE |
| 27 | 882 665 C1<br>167 713 H1 | SENDER, oil pressure<br>GROMMET |
| 28 | 188 280 H1 | CABLE, light to ignition switch |
| 29 | | SWITCH, ignition (See Wiring in Section 8) |
| 30 | 127 521 H1 | CABLE, jumper |
| 31 | | SENDER, water temperature (See Instruments and Related Parts in this section). |
| | 893 372 C1 | DECAL, gauge warning |

NOTE: Switch is moved to thermostat housing on units equipped with ETHER START.

# SECTION 12

# POWER



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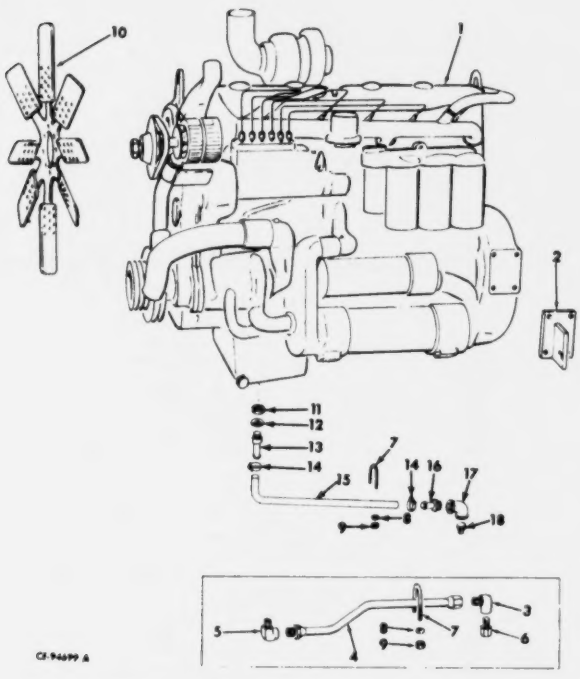
## I.H. ENGINE MOUNTING AND RELATED PARTS

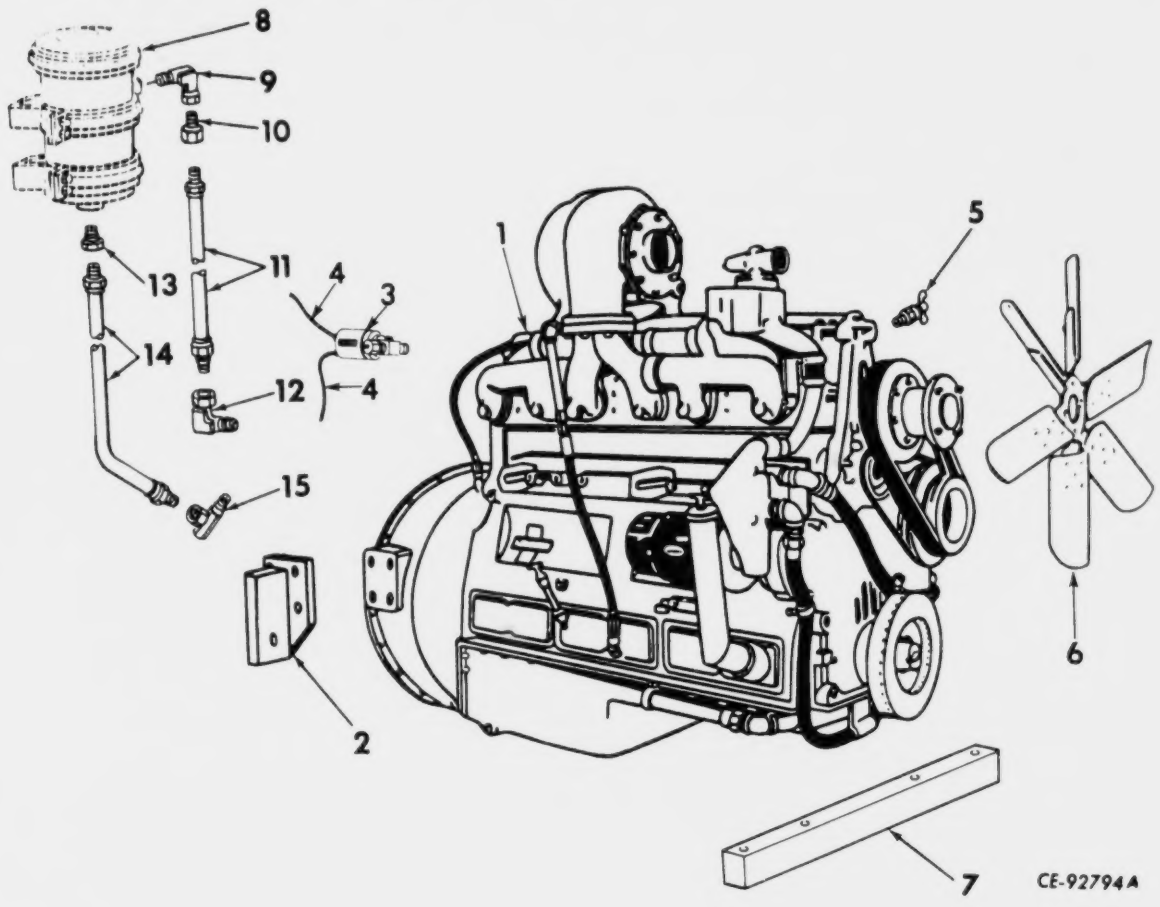



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | ENGINE (Refer to EPC-817B or 817C Parts Catalog) |
| 9 | 413 983 | NUT, lock |
| | 24 840 R1 | SCREW, 1" long (Fuel Line to Engine) (2) |
| | 25 515 R1 | SCREW, 3-1/4" long (2) |
| | 25 534 R1 | WASHER, 3/8" flat (Fuel line to Engine) (2) |
| | 25 548 R1 | WASHER, 3/4" flat (2) |
| | 205 166 H1 | WASHER, 2" O.D. flat (2) |
| 2 | 163 441 H1 | MOUNT, R.H. bell housing and engine |
| 9 | 413 986 | NUT |
| | 26 162 R1 | SCREW, 1/2 long (4) |
| | 25 777 R1 | SCREW, 3" long |
| | 25 550 R1 | WASHER, flat (2) |
| 2 | 163 442 H2 | MOUNT, L.H. bell housing and engine |
| 9 | 413 986 | NUT |
| | 26 162 R1 | SCREW, 1/2" long (4) |
| | 25 777 R1 | SCREW, 3" long |
| | 25 550 R1 | WASHER, flat (2) |
| 3 | 103 489 H1 | ELBOW, straight<br>U001179 and below<br>C001195 and below |
| 4 | 197 109 H2 | HOSE<br>U001179 and below<br>C001195 and below |
| 5 9 | 410 204<br>364 885 R1 | UNION<br>"O" RING<br>U001179 and below<br>C001195 and below |
| 6 | 444 588 | PLUG, 1/2" pipe<br>U001179 and below<br>C001195 and below |
| 7 | 107 150 H1 | "U" BOLT, oil drain |
| 8 | 103 341 | WASHER, 3/8" flat (6) |
| 9 | 18 423 R1 | NUT, 3/8" - 16NC Esna (2) |
| 10 | | FAN (See Fan in Section 6) |
| 11 | 184 697 H1 | NUT<br>U001180 and up<br>C001196 and up |
| 12 | 213 519 H1 | WASHER<br>U001180 and up<br>C001196 and up |
| 13 | 932 804 C1 | TUBE, outlet (Replaces 208 996 H1)<br>U001180 and up<br>C001196 and up |
| 14 | 333 710 R91 | CLAMP (2)<br>U001180 and up<br>C001196 and up |
| 15 | | HOSE (Cut length 3/4" ID x 21" long) (Cut from bulk HOSE, 313 244 R1)<br>U001180 and up<br>C001196 and up |
| 16 | 167 971 H1 | FITTING<br>U001180 and up<br>C001196 and up |
| 17 | 119 099 | ELBOW, 90°<br>U001180 and up<br>C001196 and up |
| 18 | 20 969 R1 | PLUG, 3/4-14 pipe<br>U001180 and up<br>U001196 and up |
| | 313 244 R1 | HOSE, bulk 3/4"ID x 50 ft. (#) (X) |

(#) - Part number and price covers one foot of bulk item.

(X) - As Required.

## CUMMINS ENGINE, MOUNTING AND RELATED PARTS




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 888 033 C92 | ENGINE, Cummins (NT-855-C) 01259* and below (Order the following parts - 1 ENGINE 896 694 92; 1 BRACKET 896 153 C1; 1 ELBOW 9 410 978; 1 HOSE 896 165 C1) |
| 1 | 896 694 C92 | ENGINE, Cummins (NT-855C1) (For components refer to Cummins Engine Manual) (Will work for ENGINE, 896 200 C91) 01260* and up |
| 2 | 184 022 H1 | MOUNT, right hand bell housing end |
| 2 | 184 023 H1 | MOUNT, left hand bell housing end |
| | 20 303 R1 | BOLT (8) |
| 3 | 924 338 C91 | RECORDER, service |
| 4 | 279 673 R91 | WIRE, seal (2) |
| 5 | 103 647 | PETCOCK, water drain |
| 6 | | FAN (See Fan in Section 6) |
| | 271 589 | 5/8NF x 2-1/2" BOLT (2) |
| | 103 325 | 5/8" lock WASHER (2) |
| 7 | 163 730 H1 | SUPPORT, engine fan end |
| | 271 598 | 5/8NF x 4-3/4" BOLT (2) |
| | 106 267 | 5/8" flat WASHER (4) |
| | 18 453 R1 | 5/8-18NF Esna NUT (2) |
| | 168 493 H1 | SPACER (2) |
| | 272 511 | INF x 2-3/4" BOLT (2) |
| | 18 462 R1 | 1"-14NF Esna NUT (2) |
| 8 | | FILTER, lubricating oil by-pass (See Cummins Engine Manual) |
| | 181 333 | 5/16NF x 5/8" BOLT (4) |
| | 103 320 | 5/16" lock WASHER (4) |
| 9 | 126 989 H1 | UNION, adapter 90° |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|
| | | **CUMMINS ENGINE, MOUNTING AND RELATED PARTS** Continued | | | |
| 10 | 152 938 H1 | REDUCER | | | |
| 11 | 183 667 H1 | HOSE, engine to lubrication filter | | | |
| 12 | 122 763 H1 | ELBOW, 90° | | | |
| 13 | 122 991 H1 | ADAPTER, union | | | |
| 14 | 183 669 H1 | HOSE, lubrication filter to engine | | | |
| 15 | 876 799 C1 | ELBOW, 90° | | | |
| | 188 959 H1 | CLAMP, exhaust pipe | | | |



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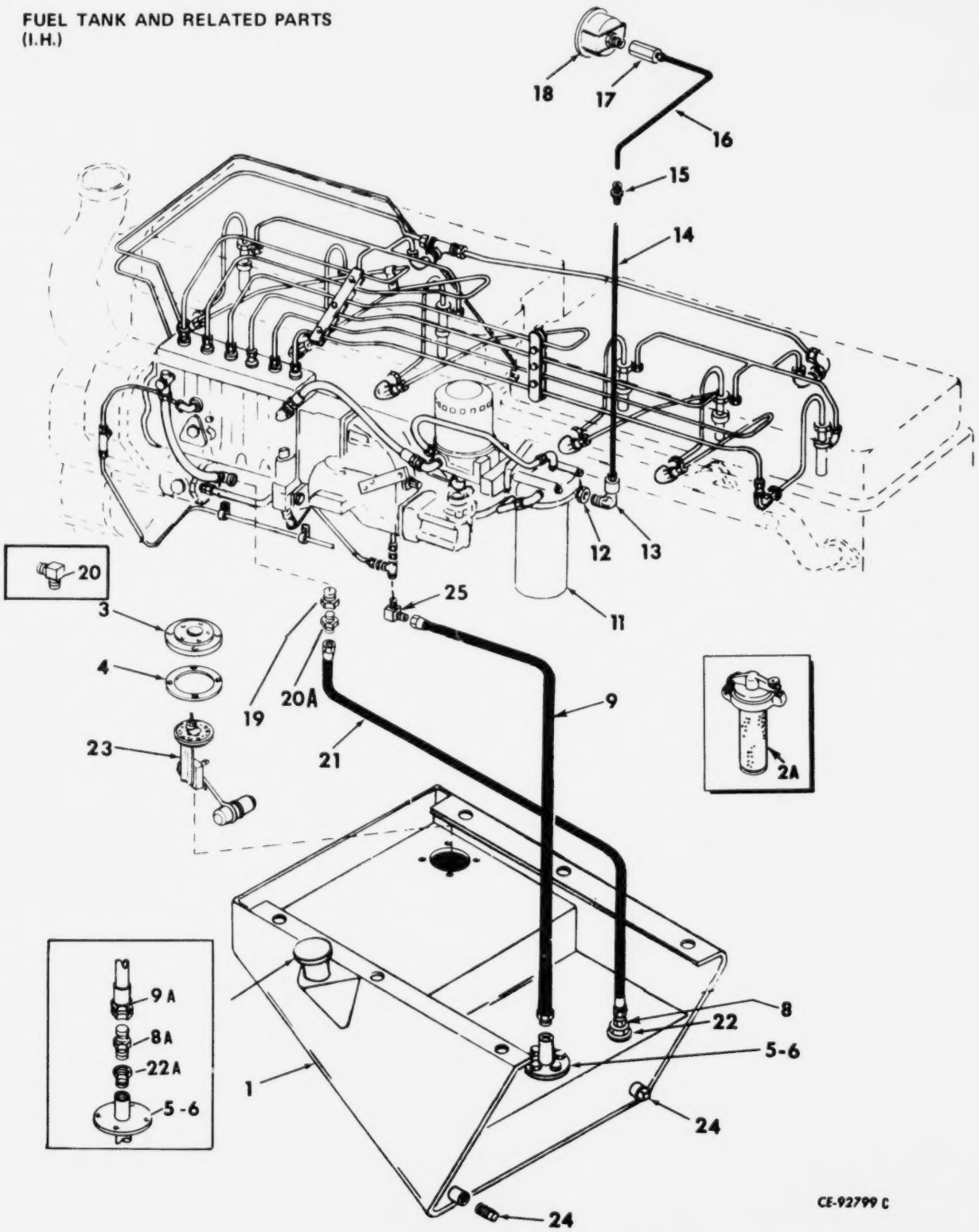
MEMORANDA

FUEL TANK AND RELATED PARTS
(I.H.)



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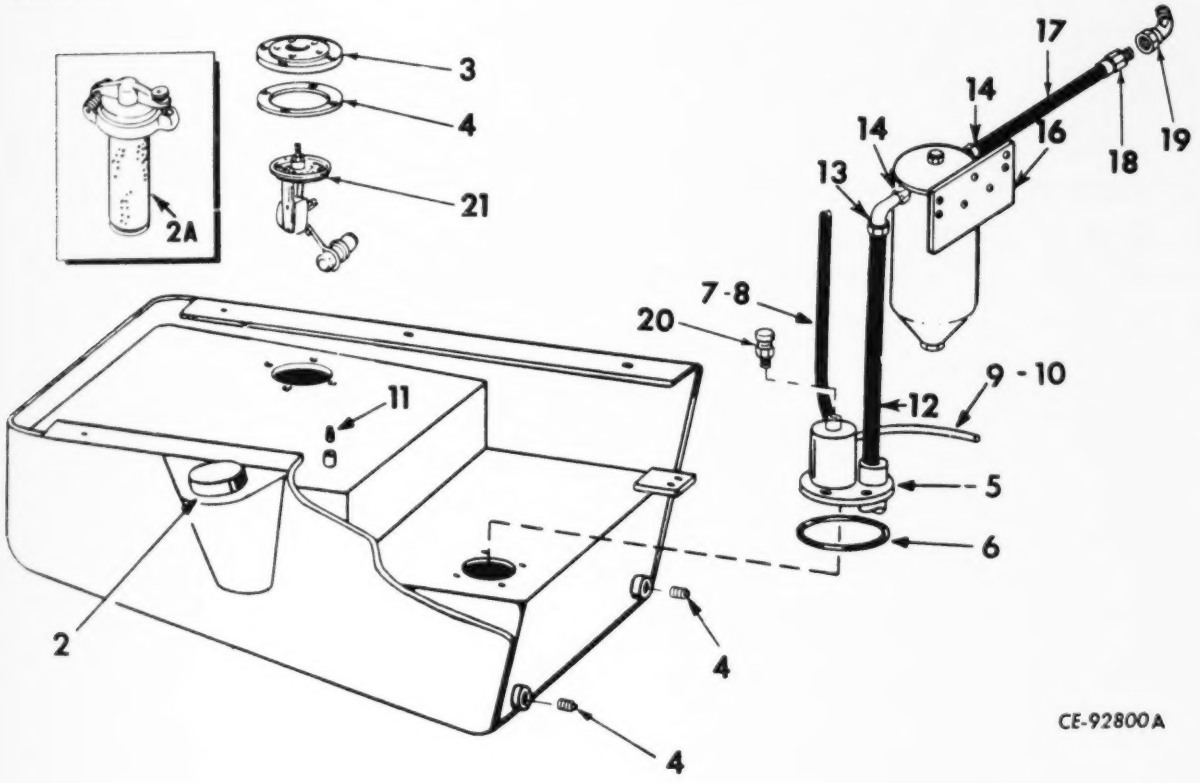
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **FUEL TANK AND RELATED PARTS - Continued (I.H.)** | | |
| 1 | 884 248 C91 | TANK, fuel |
| | 24 877 R1 | BOLT (6) |
| | 25 556 R1 | WASHER, flat (12) |
| | 9 412 231 | NUT, lock (6) |
| 2 | 193 421 H1 | CAP, fuel (Standard) |
| 2A | 116 493 H1 | CAP, fire proof (Optional) |
| 3 | 201 826 H1 | FLANGE |
| | 181 361 | 3/8NF x 7/8" BOLT (4) |
| | 120 382 | 3/8" lock WASHER (4) |
| 4 | 155 932 H2 | GASKET, flange |
| 5 | 3 046 999 R1 | "O" RING |
| 6 | 888 392 C1 | OUTLET, fuel tank |
| | 181 360 | 3/8NF x 3/4" BOLT (4) |
| | 120 382 | 3/8" lock WASHER (4) |
| 8 | 610 774 R1 | CONNECTOR |
| 8A | 610 774 R1 | CONNECTOR (Used with HOSE, 200 332 H1) |
| 9 | 200 332 H2 | HOSE, supply (Will work for HOSE, 200 332 H1) |
| 9A | 200 332 H1 | HOSE, supply (Order HOSE, 200 332 H2) |
| 11 | | FUEL, filter (Refer to EPC-817B or 817C Parts Catalog) |
| 12 | 112 877 | REDUCER |
| 13 | 36 637 D | ELBOW, w/o NUT |
| 14 | | TUBE w/o NUTS cut length 1/8"OD x 116" long cut from bulk Tube No. 417 195 C2 |
| | 36 092 D | 1/8" tube NUT (2) |
| 15 | 943 939 C1 | CONNECTOR w/o NUT |
| 16 | | TUBE w/o NUTS cut length 1/8"OD x 22" long cut from bulk Tube No. 417 195 C2 |
| | 36 092 D | 1/8" tube NUT (2) |
| 17 | 19 715 R1 | FITTING w/o NUT |
| 18 | | GAUGE, fuel pressure (See Instruments and Related Parts in Section 11) |
| 19 | 444 012 | ADAPTER (Used w/ELBOW, 9 402 864) U001496 and below C0 * and below |
| 20 | 9 402 864 | ELBOW U001496 and below C0 * and below |
| 20 | 585 694 R1 | ELBOW U001497 to 1772 except 1750-1752, 1753, 1755-1768, 1770, and 1772 C00 * to 1740 |
| 20A | 9 402 708 | CONNECTOR U001750, 51, 52, 54, 69, 71, 73 and up C001741 and up |
| 21 | 884 160 C1 | HOSE, return |
| 22 | 144 046 | BUSHING |
| 22A | 144 046 | BUSHING (Used with HOSE, 200 332 H1) |
| 23 | 891 418 C1 | SENDER, fuel level |
| | 163 578 H1 | SCREW (5) |
| 24 | 444 588 | PIPE, plug (2) |
| 25 | 333 934 R1 | ELBOW |
| | 935 522 C1 | STRAP, hose return (15) |
| | 417 195 C2 | TUBE, bulk - 1/8" x 100 ft. |

* - Serial Number Not Available.

FUEL TANK AND RELATED PARTS
(Cummins)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 884 248 C91 | TANK, fuel |
| | 24 877 R1 | BOLT (6) |
| | 25 556 R1 | WASHER, flat (12) |
| | 9 412 231 | NUT, lock (6) |
| 2 | 193 421 H1 | CAP (Standard) |
| 2A | 116 493 H1 | CAP, fireproof (Optional) |
| 3 | 155 932 H1 | GASKET, flange |
| 4 | 201 826 H1 | FLANGE |
| | 181 360 | 3/8NF x 3/4" BOLT (4) |
| | 120 382 | 3/8" lock WASHER (4) |
| 4A | 444 588 | PIPE, plug (2) |
| 5 | 888 416 C1 | MANIFOLD, suction (With hole for Breather Tube) (Order MANIFOLD, 922 290 C1) |
| 5 | 922 290 C1 | MANIFOLD, suction |
| | 181 360 | 3/8NF x 3/4" BOLT (4) |
| | 103 321 | 3/8 lock WASHER (4) |
| 6 | 3 046 999 R1 | "O" RING |
| 7 | 178 573 H1 | HOSE, return line |
| 8 | 139 676 H1 | ADAPTER, straight |
| 9 | HS-972 | CONNECTOR (Used with MANIFOLD, 888 416 C1) |
| 10 | 145 325 H1 | TUBE, breather (Used with MANIFOLD, 888 416 C1) |
| 11 | 445 686 | PLUG, pipe 3/8" |
| 12 | 151 021 H1 | HOSE, supply |
| 13 | 9 410 978 | ELBOW |
| 14 | 364 885 R1 | "O" RING (2) |
| 15 | | FILTER, fuel (See Cummins Engine Manual) |
| 16 | 883 045 C1 | BAR, fuel filter mounting |
| | 181 465 | 9/16NF x 3-1/2" BOLT (4) |
| | 103 324 | 9/16" lock WASHER (4) |
| | 475 988 R1 | SPACER (4) |
| | 103 322 | 7/16" lock WASHER (3) |
| | 271 505 | 7/16NF hex NUT (3) |
| | 181 395 | 7/16NF x 1" BOLT (3) |



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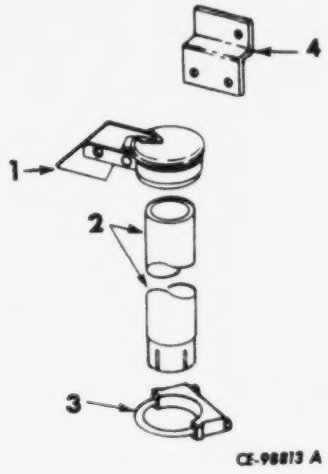
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FUEL TANK AND RELATED PARTS (Cummins) - Continued** |
| 17 | 181 823 H1 | HOSE, fuel line return 01259 and below |
| 17 | 896 165 C1 | HOSE, fuel line return 01260 and up |
| 18 | 204 933 H1 | CONNECTOR 01259 and below |
| 19 | 9 410 256 | ELBOW, 45° 01259 and below |
| 19 | 9 410 978 | ELBOW, 90° 01260 and up |
| 20 | 152 127 H1 | VENT |
| 21 | 886 251 C1 | SENDER, fuel |
| | 163 578 H2 | SCREW (5) |
| | 9 402 710 | CONNECTOR (From Filter to hose outlet) |

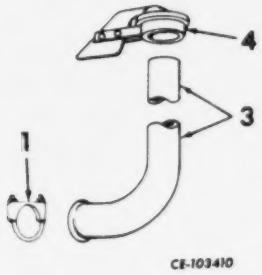
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

EXHAUST PIPE (I.H. Engine)
U001290 and below
C001228 and below



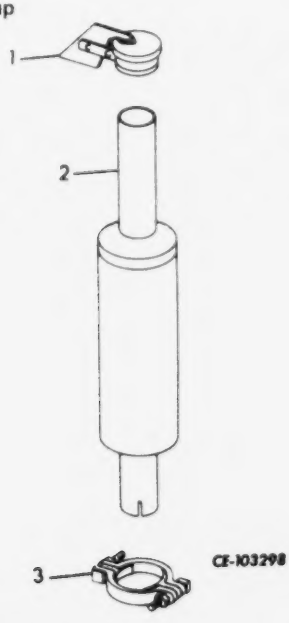

| | | |
|---|---|---|
| 1 | 610 210 C91 | CAP, weather |
| 2 | 884 045 C1 | PIPE, exhaust |
| 3 | 188 959 H1 | CLAMP, full circle |
| 4 | | Not Used |

EXHAUST PIPE (Cummins Engine)
U001290 and below
C001228 and below




| | | |
|---|---|---|
| 1 | 188 959 H1 | CLAMP |
| 3 | 884 022 C1 | PIPE, exhaust |
| 4 | 610 210 C91 | CAP, weather |

MUFFLER
U001291 and up
C001229 and up




| | | |
|---|---|---|
| 1 | 610 210 C91 | CAP, weather |
| 2 | 922 406 C2 | MUFFLER (I.H. Engine) |
| 2 | 926 011 C2 | MUFFLER (Cummins Engine) |
| | 103 341 | WASHER, 3/8" flat (4) |
| | 103 321 | WASHER, 3/8" lock (4) |
| | 102 635 | NUT, 3/8"NC (4) |
| 3 | 188 959 H1 | CLAMP (Cummins Engine) (2) |
| 3 | 878 016 C91 | CLAMP (I.H. Engine) (2) |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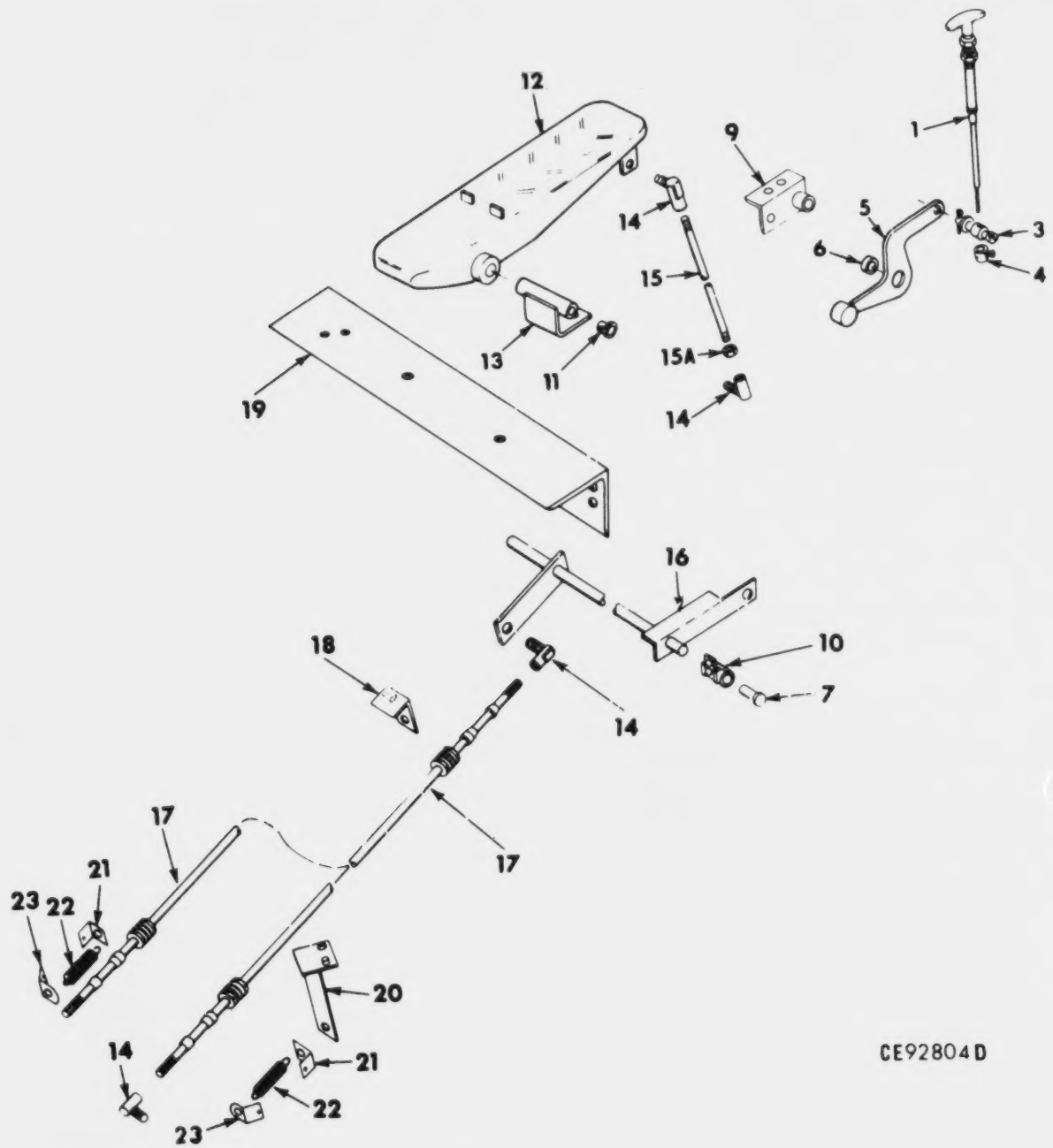
MEMORANDA

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

ACCELERATOR LINKAGE



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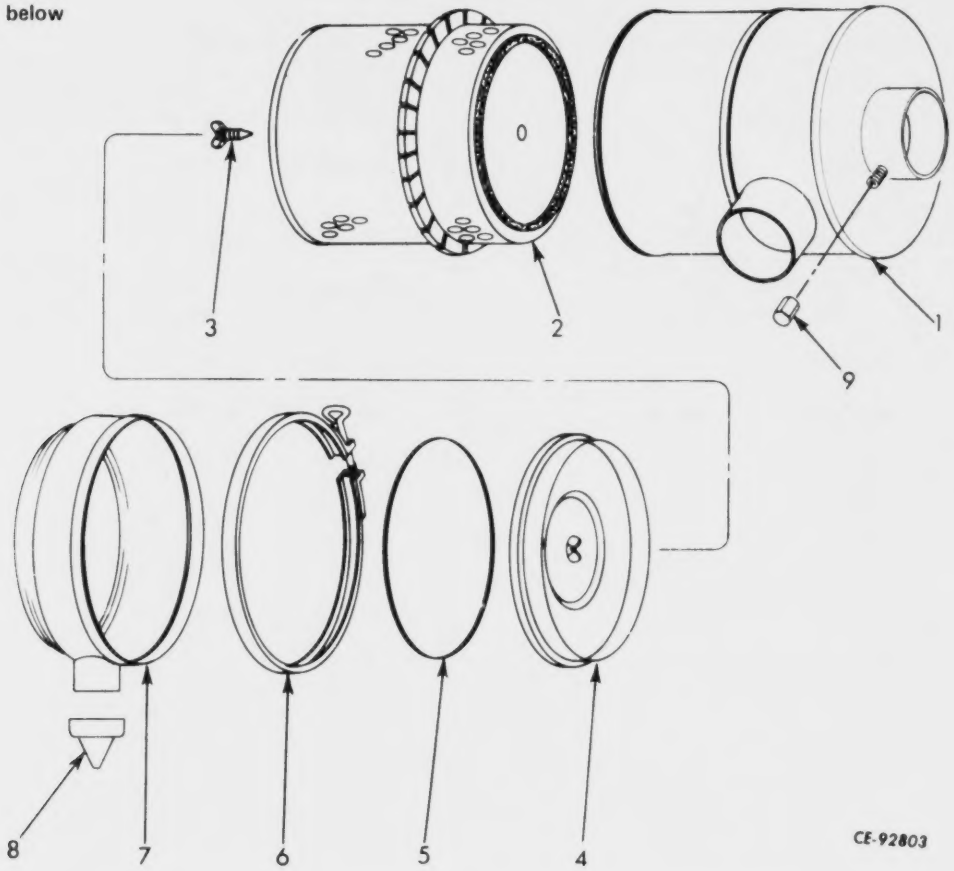
ACCELERATOR LINKAGE – Continued

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 1 131 805 C1 | CABLE, w/handle, 170 273 C1 hand control |
| 3 | 172 842 H1 | FITTING, lever |
| 4 | 879 100 C91 | CLAMP |
| 5 | 879 602 C2 | LEVER |
| | 181 365 | 3/8NF x 1" BOLT |
| | 103 341 | 3/8" flat WASHER (2) |
| | 103 026 | 3/8NF hex NUT |
| | 120 382 | 3/8" lock WASHER |
| 6 | 879 046 C1 | SPACER |
| 7 | 164 263 H1 | BUSHING (Order Bearing, 894 389 C1) (2) |
| 8 | 103 373 | PIN, cotter |
| 9 | 890 181 C1 | ANGLE |
| | | 1/4NF x 3/4" BOLT (2) |
| | 103 319 | 1/4" lock WASHER (2) |
| | 103 024 | 1/4" Esna NUT (2) |
| 10 | 165 126 H1 | BEARING (Order Bearing, 894 389 C1) (2) |
| 10 | 894 389 C1 | BEARING (2) |
| | 181 315 | 1/4NF x 1" BOLT (4) |
| | 103 319 | 1/4" lock WASHER (4) |
| | 103 024 | 1/4NF hex NUT (4) |
| 11 | 370 686 R1 | BUSHING (2) |
| 12 | 875 853 C1 | PEDAL w/HINGE, 875 857 C1 and two BUSHING, 370 686 R1 |
| | 103 024 | NUT (2) |
| | 181 314 | SCREW, hex-hd cap (2) |
| | 120 380 | WASHER, lock (2) |
| 13 | 875 857 C1 | HINGE |
| 14 | 158 396 H1 | JOINT, ball (3) |
| | 19 503 R1 | 5/16-24NF Esna NUT (3) |
| 15 | 121 186 H1 | ROD |
| 15A | 114 493 | NUT, 5/16NF hex (2) |
| | 890 179 C1 | BELLCRANK |
| | 886 310 C1 | CABLE, control |
| | 114 493 | 5/16NF Esna NUT (2) |
| 17 | 890 182 C2 | ANGLE |
| | 181 315 | 1/4NF x 1" BOLT (2) |
| | 103 339 | 1/4" flat WASHER (2) |
| | 20 090 R1 | 1/4-28NF Esna NUT (2) |
| 19 | 886 053 C1 | ANGLE |
| | 181 336 | 5/16NF x 3/4" BOLT (2) |
| | 120 214 | 5/16" lock WASHER (2) |
| | 103 025 | 5/16NF hex NUT (2) |
| 20 | 891 620 C1 | BRACKET |
| | | 01259 and below |
| 20 | 896 153 C1 | BRACKET |
| | | 01260 and up |
| | 181 450 | 9/16NF x 7/8" BOLT |
| | 103 324 | 9/16" lock WASHER |
| 21 | 201 436 H1 | CLIP |
| 22 | 190 154 H1 | SPRING |
| 23 | HA-932 | CLIP |
| | 143 142 H1 | CLAMP, cable control |
| | | U001108 and down except 01097 |
| | | C001002 and up |
| | 896 086 C1 | CLAMP |
| | 25 519 R1 | NUT |
| | 9 413 977 | NUT, lock |
| | 25 222 R1 | SCREW |
| | 25 532 R1 | WASHER, 1/4" flat (2) |
| | 25 533 R1 | WASHER, 5/16" flat (2) |
| | 936 977 C1 | ROD, pedal stop |
| | 25 520 R1 | NUT (2) |
| | 25 543 R1 | WASHER, flat (2) |

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

AIR CLEANER
U001290 and below
C001287 and below




| | | |
|---|---|---|
| | 884 044 C91 | CLEANER, air (Consists of the following parts |
| 1 | | BODY (Not Furnished Separately) |
| 2 | 304 766 C92 | ELEMENT |
| 3 | 155 208 H1 | BOLT, w/gasket washer |
| 4 | 885 017 C1 | BAFFLE |
| 5 | 309 046 R1 | "O" RING |
| 6 | 321 933 R91 | CLAMP |
| 7 | 885 018 C1 | CUP |
| 8 | 213 773 H1 | VALVE, vacuator |
| 9 | 164 710 H1 | CAP |
| | 387 067 R1 | SPRING, outlet |



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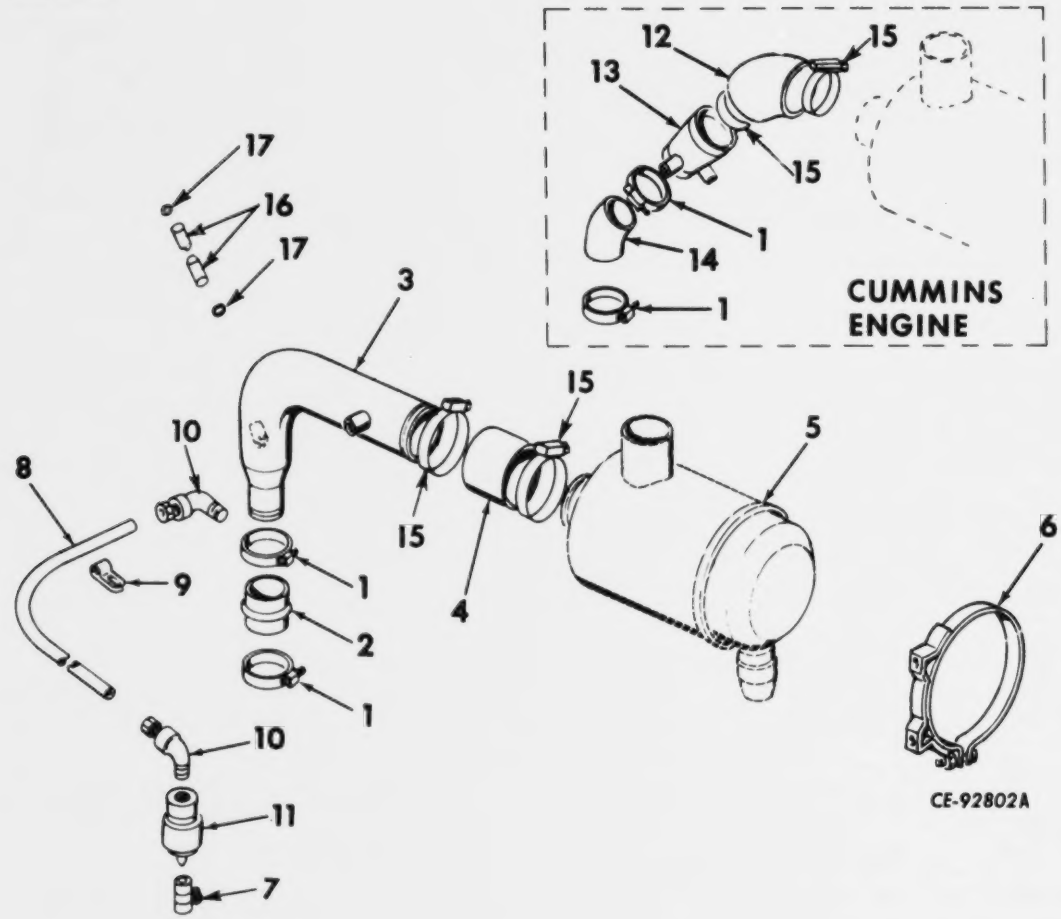
AIR CLEANER CONNECTIONS
U001290 and below
C001287 and below




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 309 693 R1 | CLAMP, hose I.H. (2) |
| 1 | 371 677 R91 | CLAMP, hose (Cummins) (2) |
| 2 | 309 992 R1 | HOSE, tube to engine (I.H.) |
| 3 | 884 009 C1 | TUBE (I.H.) |
| 4 | 425 309 R1 | HOSE, cleaner to tube (I.H.) |
| 5 | | CLEANER, air (See Air Cleaner in this Section) |
| 6 | 175 403 H1 | CLAMP (2) |
| | 181 360 | 3/8NF x 3/4 BOLT (4) |
| | 120 382 | 3/8" lock WASHER (4) |
| 7 | 884 131 C1 | SPACER |
| | 181 349 | BOLT, 5/16NF x 2-1/2" |
| | 120 214 | WASHER, 5/16" lock |
| | 103 025 | NUT, 5/16"NF |
| 8 | | TUBE w/o NUT, cut length 1/4" OD x 50" cut from bulk tube 417 196 C2 |
| | 29 898 D | NUT, 1/4" tube (2) |
| 9 | 210 039 H1 | CLAMP |
| 10 | 30 402 D | ELBOW, w/o NUT (2) |
| | 414 504 C1 | INSERT (2) |
| 11 | 877 601 C1 | INDICATOR, service |
| 12 | 878 618 C1 | HOSE, cleaner to tube (Cummins) |
| 13 | 884 014 C1 | TUBE (Cummins) |
| 14 | 178 080 H1 | HOSE, tube to engine (Cummins) |
| 15 | 427 312 R91 | CLAMP, hose cleaner to tube (2) |

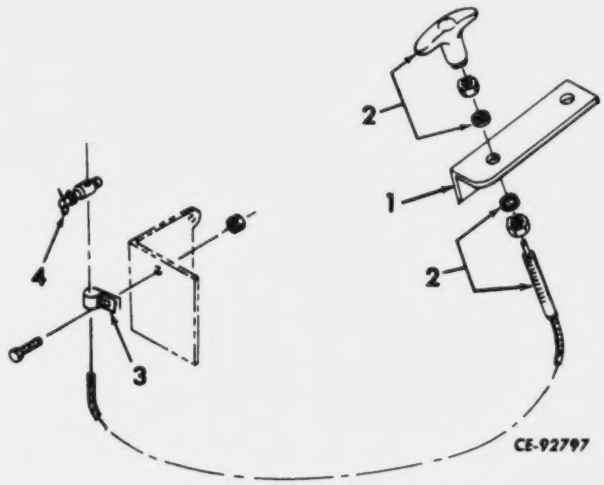
(Continued on next page)

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **AIR CLEANER CONNECTIONS - Continued** | | |
| **U001290 and below** | | |
| **C001287 and below** | | |
| 16 | | HOSE, tube to compressor (I.H.)<br>(Cut length 3/4" I.D. x 46" long)<br>(Cut from bulk hose, 313 244 R1) |
| 17 | 333 710 R91 | CLAMP (I.H.) (2) |
| | 417 196 C2 | TUBING, bulk 1/4 x 50 feet (X) |
| | 313 244 R1 | HOSE, bulk 3/4" I.D. x 50 ft. (*) (X) |

(*) - Part number and price covers one foot of bulk item.

(X) - As Required.

**ENGINE SHUTDOWN**




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 884 165 C1 | SUPPORT |
| 2 | 884 167 C1 | CABLE w/HANDLE, 920 158 C1, shutdown |
| 3 | 105 245 | CLAMP |
| | 181 309 | 1/4NF x 1/2" BOLT |
| | 20 090 R1 | 1/4-28NF Esna NUT |
| 4 | 172 842 H1 | FITTING, connector |
| | 935 464 C1 | CLAMP, cable shutdown (2) |
| | 920 158 C1 | HANDLE |



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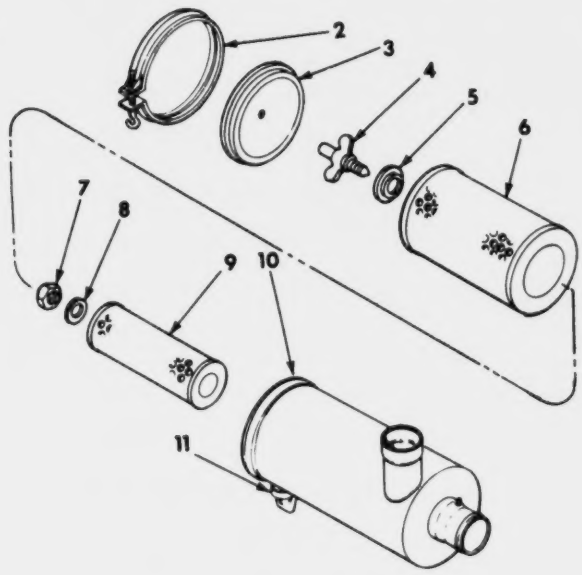
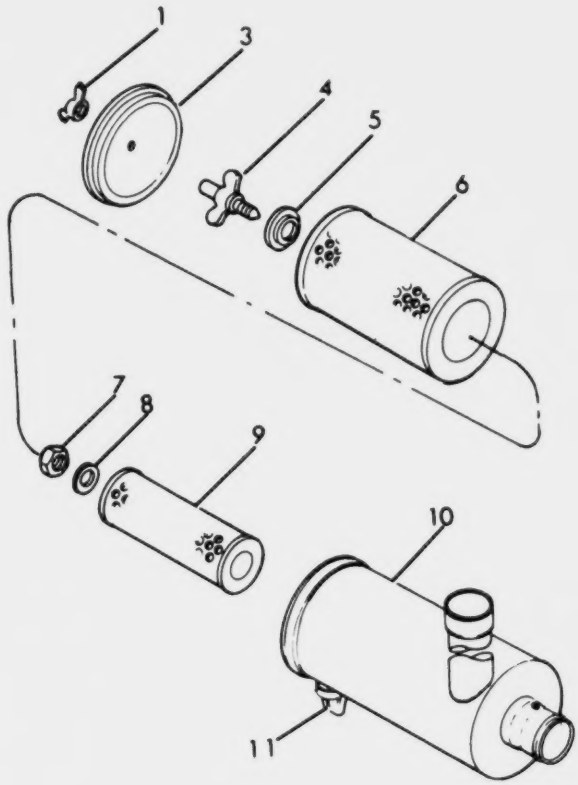
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | **AIR CLEANER**<br>**U001291 and up**<br>**C001288 and up** | |




CE-103555

| | | |
|---|---|---|
| | 700 688 C91 | CLEANER, air (Order Air Cleaner, 929 376 C91) (Consists of the following parts - |
| 2 | 702 668 C91 | CLAMP, cover |
| 3 | 702 699 C1 | COVER, element |
| 4 | 702 670 C1 | BOLT, wing |
| 5 | 702 671 C1 | SEAL, wing bolt |
| 6 | 702 672 C1 | ELEMENT, primary |
| 7 | 102 609 R1 | NUT, element stop |
| 8 | 619 052 C1 | WASHER, nut |
| 9 | 702 673 C1 | ELEMENT, safety |
| 10 | | BODY, air cleaner (Not furnished separately) |
| 11 | 615 679 C1 | UNLOADER, air cleaner |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | **AIR CLEANER**<br>**U001291 and up**<br>**C001288 and up** | |

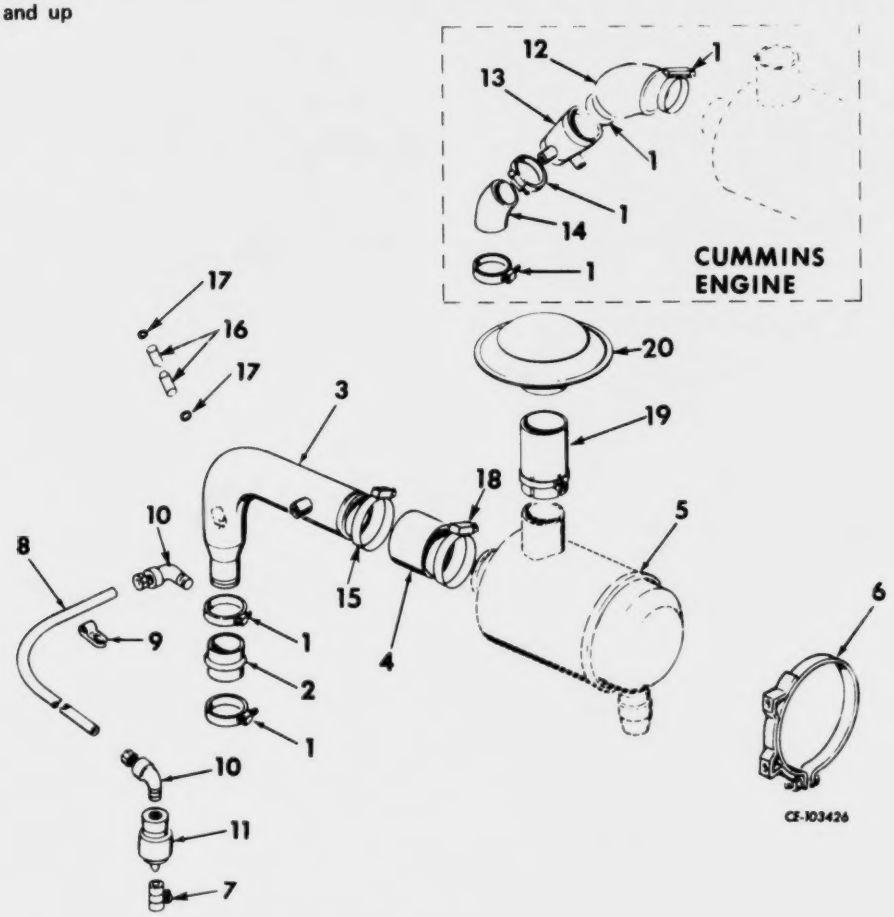



CE-103296

| | | |
|---|---|---|
| | 929 376 C91 | CLEANER ASSY, air (Consists of the following parts - |
| 1 | | NUT, element cover (Part of Element Cover) |
| 3 | 929 642 C1 | COVER, element |
| 4 | 929 641 C1 | NUT, wing |
| 5 | 920 718 C1 | WASHER, seal |
| 6 | 702 672 C1 | ELEMENT, primary |
| 7 | 102 609 R1 | NUT, element stop |
| 8 | 920 718 C1 | WASHER, seal |
| 9 | 702 673 C1 | ELEMENT, safety |
| 10 | | BODY, air cleaner (Not furnished separately) |
| 11 | 615 679 C1 | UNLOADER, dust |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

AIR CLEANER CONNECTIONS
U001291 and up
C001288 and up




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 27 314 R1 | CLAMP, hose (2) |
| 1 | 371 677 R91 | CLAMP, hose (Cummins) (4) |
| 2 | 309 992 R1 | HOSE, tube to engine (I.H.) |
| 3 | 884 009 C1 | TUBE (I.H.) |
| 4 | 894 698 C1 | HOSE, cleaner to tube (I.H.) |
| 5 | | CLEANER, air (See Air Cleaner in this Section) |
| 6 | 175 403 H1 | CLAMP (2) |
| | 181 364 | BOLT (4) |
| | 120 382 | WASHER, lock (4) |
| | 137 338 H1 | SPACER (4) |
| 7 | 884 131 C1 | SPACER |
| | 181 349 | BOLT |
| | 120 214 | WASHER, lock |
| | 103 025 | NUT |
| 8 | | TUBE, w/o NUT, cut length 1/4" OD x 50" cut from bulk tube 417 196 C2 |
| | 29 898 D | NUT, 1/4" tube (2) |
| 9 | 210 039 H1 | CLAMP |
| 10 | 67 869 D | ELBOW, w/o NUT (2) |
| | 414 504 C1 | INSERT (2) |
| 11 | 877 601 C1 | INDICATOR, service |
| 12 | 178 080 H1 | HOSE, cleaner to tube (Cummins) |
| 13 | 922 983 C1 | TUBE (Cummins) |
| 14 | 178 080 H1 | HOSE, tube to engine (Cummins) |
| 15 | 436 937 R91 | CLAMP, hose to tube |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| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

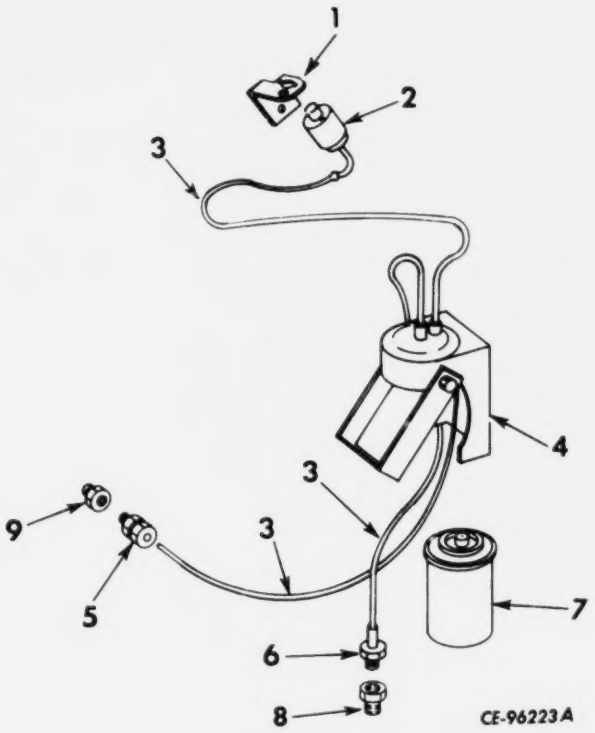
**AIR CLEANER CONNECTIONS** - Continued
**U001291 and up**
**C001288 and up**

| | | |
|---|---|---|
| 16 | | HOSE, tube to compressor (I.H.)<br>(Cut length 3/4" I.D. x 46" long)<br>(Cut from bulk HOSE, 935 722 C1) |
| 17 | 333 710 R91 | CLAMP (I.H.) (2) |
| 18 | 434 890 R91 | CLAMP |
| 19 | 317 800 R91 | TUBE |
| 20 | 313 630 R91 | HOOD |
| | 348 828 C1 | FILTER, service indicator |
| | 935 722 C1 | HOSE, bulk 3/4" I.D. x 50 feet |
| | 105 404 | NIPPLE, 1/8" x 3/4 |
| | 417 196 C2 | TUBING, bulk 1/4 x 50 feet (X) |

(X) - As Required.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

ETHER STARTING AID KIT




Parts without letters after the description indicates the part is used for all Ether Starting Kits. Letters A and B are used to identify separate Kits.

| | | |
|---|---|---|
| A | 891 414 C91 | KIT, ether starting aid (I.H.) (See Note 1) |
| B | 891 412 C91 | KIT, ether starting aid (Cummins) (See Note 1) |
| 1 | | NOT USED |
| 2 | 883 752 C1 | ACTUATOR |
| | 132 900 | No. 10 x 3/8" slt-rd-hd-mach. SCREW (2) |
| 3 | 883 421 C1 | TUBING |
| 4 | 884 869 C1 | BRACKET |
| | 181 313 | 1/4NF x 3/4" BOLT (2) |
| | 103 319 | 1/4" lock WASHER (2) |
| | 103 024 | 1/4"NF hex NUT (2) |
| 5 | 884 618 C1 | NOZZLE |
| 6 | 884 617 C1 | CONTROL, injection |
| 7 | | FLUID, starting (Order from local distributor) |
| 8 | 144 045 | BUSHING (Into Water Manifold) (Kit A) |
| 8 | 144 043 | BUSHING (Into Water Manifold) (Kit B) |
| 9 | 112 877 | ADAPTER (Engine air manifold) |
| | 879 794 C91 | KIT, starting (Consists of - 1 ACTUATOR 883 752 C1; 1 BRACKET 884 869 C1; 1 CONTROL 884 617 C1; 1 NOZZLE 884 618 C1; 1 NUT 406 595 C1; 1 SLEEVE 884 616 C1; 1 TUBING 883 421 C1) |
| | 884 507 C1 | DECAL, cold start |
| | FCH-11463 | DRAWING, cold start |
| | 406 595 C1 | NUT (Part of Starting Kit, 879 794 C91) |
| | 884 616 C1 | SLEEVE (Part of Starting Kit, 879 794 C91) |

NOTE 1: Order on Machine Order Form.



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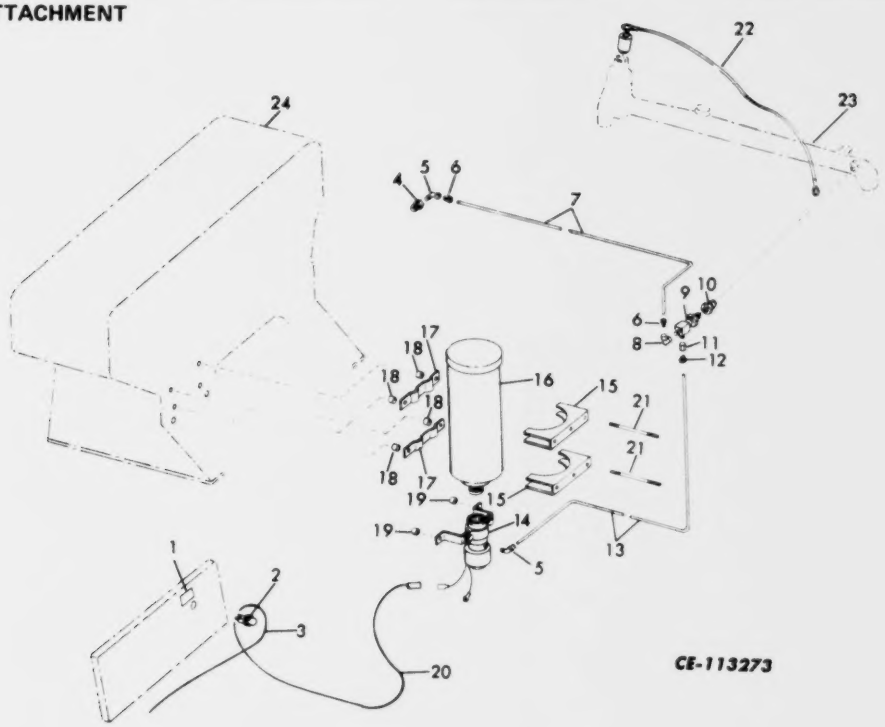
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## ETHER START ATTACHMENT

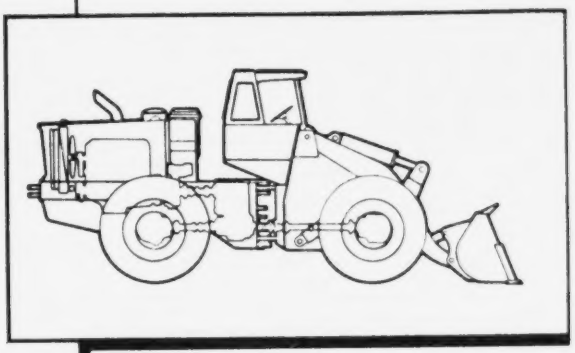



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 1 130 002 C91 | ETHER START ATTACHMENT (I.H.) (Consists of the following parts - |
| 1 | 1 104 424 C1 | PRODUCT GRAPHIC |
| 2 | 453 453 C1 | SWITCH |
| 3 | 876 026 C1 | CABLE (Orange) |
| 4 | 269 635 R91 | NOZZLE |
| 5 | 36 637 D | ELBOW (2) |
| 6 | 36 092 D | NUT (2) |
| 7 | | TUBE, 1/8" x 72" long thermocloz to manifold (Cut from bulk TUBE, 417 195 C2) |
| 8 | 19 376 R1 | ELBOW |
| 9 | 930 309 C1 | THERMOCLOZ |
| 10 | 444 034 | BUSHING |
| 11 | 20 735 R1 | UNION |
| 12 | 36 092 D | NUT |
| 13 | | TUBE, ether start valve to thermocloz (1/8" x 60" long) (Cut from bulk TUBE, 417 195 C2) |
| 14 | 1 104 453 C91 | VALVE and COIL |
| | 174 916 | WASHER, lock |
| | 25 532 R1 | WASHER, hardened |
| | 25 752 R1 | BOLT, hex (2) |
| 15 | 1 102 178 C1 | SADDLE (2) |
| 16 | | CYLINDER, starting fluid (purchase locally) |
| 17 | 1 102 177 C1 | BRACKET (2) |
| 18 | 153 749 H1 | BOSS, tapped 5/16"NC (4) |
| 19 | 924 232 C1 | BOSS, tapped 1/4"NC (2) |
| 20 | 1 110 202 C1 | CABLE (white w/red trace) push button switch to valve |
| 21 | 1 102 176 C1 | STUD (4) |
| | 25 520 R1 | NUT, hex (8) |
| | 120 214 | WASHER, lock (8) |
| 22 | 892 254 C1 | CABLE (Green) |
| 23 | | MANIFOLD, water (Refer to "Front and Rear Water Manifold" in EPC-817C) |
| 24 | | BULKHEAD (Refer to BULKHEAD in Section 13) |
| | 172 832 H1 | ELBOW, 36 637 D w/NUT, 36 092 D (2) |
| | FGH 15 792 | DRAWING, bulkhead re-work |
| | 417 195 C2 | TUBE, bulk (1/8"OD x 100') (X) |

(X) - As Required.

# SECTION 13

# SUPERSTRUCTURE



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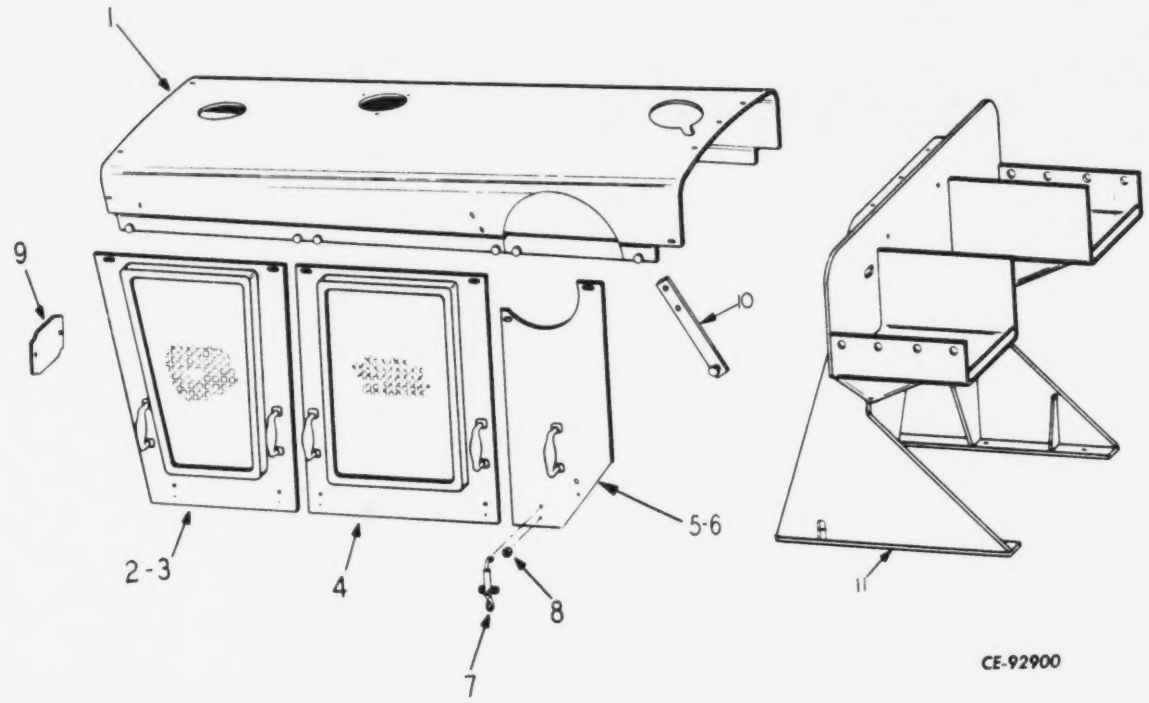
BULKHEAD, COWLING AND PANELS



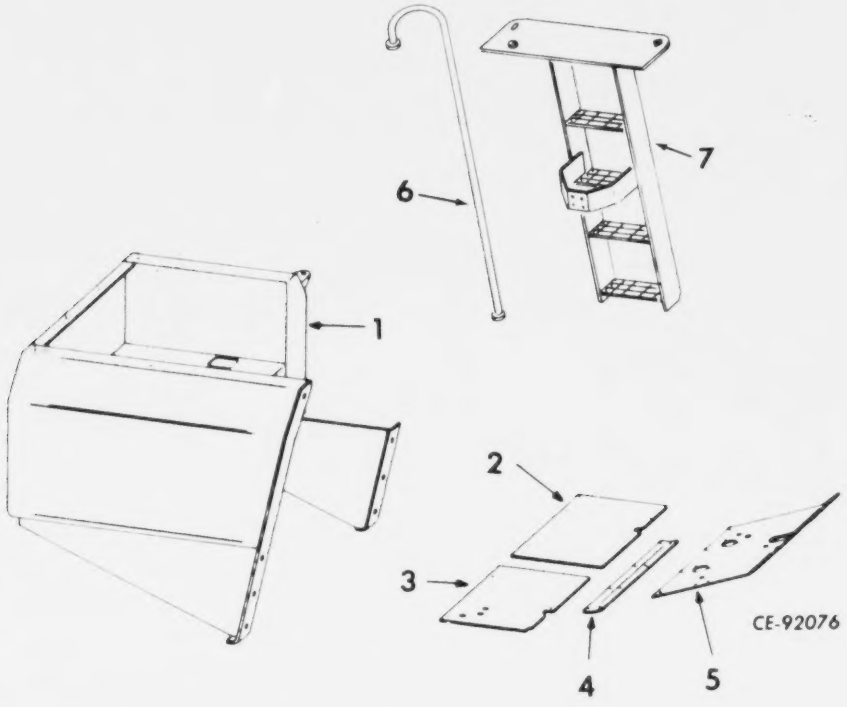

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 884 011 C1 | HOOD, rear (L.H.)<br>U001290 and below<br>C001287 and below |
| 1 | 922 651 C1 | HOOD, rear (I.H.)<br>U001291 and up<br>C001288 and up |
| 1 | 884 020 C2 | HOOD, rear (Cummins)<br>U001021 and below<br>C001002 thru* |
| 1 | 892 240 C1 | HOOD, rear (Cummins) (Used with ENGINE, 896 200 C91)<br>U001022 thru *<br>C0* thru * |
| 1 | 896 646 C1 | HOOD, rear (Cummins) (Used with ENGINE, 896 694 C91)<br>U0* thru 01290<br>C0* thru 01287 |
| 1 | 926 016 C1 | HOOD, rear (Cummins) (Used with Engine, 896 694 C92)<br>U001291 and up<br>C001288 and up |
| | 181 374 | 3/8NF x 1-1/2" BOLT (4) |
| | 120 382 | 3/8" lock WASHER (11) |
| | 103 026 | 3/8"NF hex NUT (11) |
| | 181 364 | 3/8NF x 1" BOLT (5) |
| | 106 265 | 3/8" flat WASHER (5) |
| | 106 263 | 3/8" flat WASHER (19) |
| 2 | 889 593 C2 | PANEL, rear R.H. |
| 3 | 889 592 C2 | PANEL, rear L.H. |
| 4 | 177 136 H2 | PANEL, rear center (2) |
| 5 | 884 013 C3 | PANEL, side forward R.H. |
| 6 | 198 667 H2 | PANEL, side forward L.H. |
| 7 | 258 222 R92 | LATCH (12) |
| | 168 753 H1 | SCREW, drive (36) |
| 8 | 153 619 H1 | BUMPER, panel latch (12) |
| | 153 640 H1 | SCREW (12) |
| | 120 622 | No. 8 - 32 hex NUT (12) |
| | 121 841 | No. 8 lock WASHER (12) |
| 9 | 884 249 C1 | BAR, cover (Not used with Counterweight Kit or H-100C Military) |
| | 103 026 | NUT, 3/8"NF hex (2) |
| | 103 321 | WASHER, 3/8" lock (2) |

* - Serial number not available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **BULKHEAD, COWLING AND PANELS - Continued** |
| 10 | 884 007 C1 | SUPPORT |
| | 181 361 | BOLT (2) |
| | 106 263 | WASHER, flat (4) |
| | 9 413 979 | NUT (2) |
| 11 | 884 025 C2 | BULKHEAD (Not used with H-100C Military) |
| 11 | M1 134 398 C1 | BULKHEAD (Used with H-100C |
| | 24 891 R1 | BOLT (6) |
| | 25 548 R1 | WASHER, flat (12) |
| | 9 413 983 | NUT (6) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

OPERATORS COMPARTMENT AND LADDER




| | | |
|---|---|---|
| 1 | 884 043 C1 | COMPARTMENT, drivers (Order COMPARTMENT, 936 747 C1 w/PEDESTAL, 922 229 C91) |
| 1 | 892 991 C4 | COMPARTMENT, drivers (Not used on units equipped w/Auxiliary Instrument Kit) (Order COMPARTMENT, 936 747 C1), four NUT, 27 008 R1, four SCREW, 25 726 R1 and eight WASHER, 25 558 R1) |
| 1 | 936 747 C1 | COMPARTMENT, drivers (Not used on units equipped w/Auxiliary Instrument Kit) |
| 9 | 413 983 | NUT (3) |
| | 24 890 R1 | SCREW, hex-hd cap (3) |
| | 25 548 R1 | WASHER, flat (6) |
| 1 | 891 304 C1 | COMPARTMENT, drivers (Used only on units equipped w/Auxiliary Instrument Kit) |
| | 18 558 R1 | NUT, Esna (7) |
| | 271 635 | SCREW, hex-hd cap (7) U001570 and below C0* and below |
| 9 | 413 983 | NUT, Esna (3) |
| | 24 890 R1 | SCREW, hex-hd cap (3) |
| | 25 548 R1 | WASHER, flat (6) U001571 and up C0* and up |
| 2 | 195 679 H1 | FLOORBOARD, rear L.H. (Not used on units equipped with Roll-Over Protection System) |
| | 181 364 | BOLT, 3/8NF x 1" (2) |
| | 103 321 | WASHER, 3/8" lock (2) |
| | 106 263 | WASHER, 3/8" flat (4) |
| | 181 374 | BOLT, 1/2NF x 1-1/2" (2) |
| | 103 321 | WASHER, 3/8" lock (4) |
| | 103 026 | NUT, 3/8NF hex (2) |
| 3 | 884 061 C1 | FLOORBOARD, rear RH (Not used on units equipped with Roll-Over Protection System) |
| | 181 364 | BOLT, 3/8NF x 1" (2) |
| | 103 321 | WASHER, 3/8" lock (4) |

* - Serial Number Not Available.



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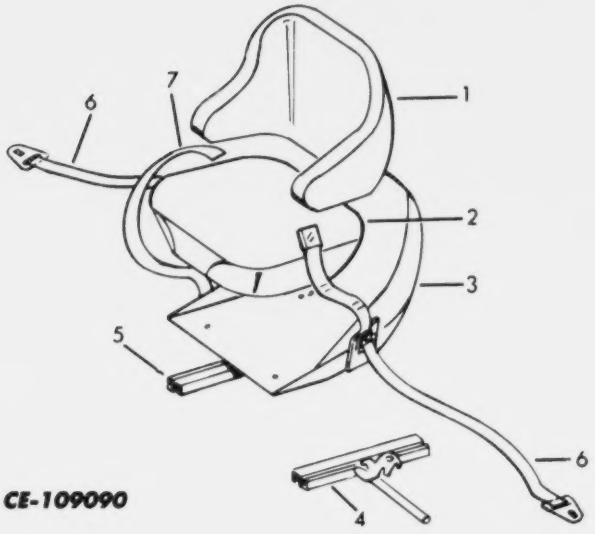
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

OPERATORS COMPARTMENT AND LADDER - Continued

| | | |
|---|---|---|
| | 106 263 | WASHER, 3/8" flat (4) |
| | 181 374 | BOLT, 1/2NF x 1-1/2" (2) |
| | 103 321 | WASHER, 3/8" lock (2) |
| | 103 206 | NUT, 3/8NF hex (2) |
| 4 | 198 438 H1 | RUNNER |
| | 103 028 | NUT, 1/2" (2) |
| | 25 772 R1 | SCREW, 3/8" x 1" hex-hd cap (4) |
| | 80 297 R1 | SCREW, 3/8" x 1-1/2" hex-hd cap (2) |
| | 181 431 | SCREW, 1/2" x 1-1/2" hex-hd cap (2) |
| | 25 534 R1 | WASHER, 3/8" flat (6) |
| | 120 384 | WASHER, 1/2" lock (2) |
| | 106 263 | WASHER, 1/2" flat (2) |
| 5 | 884 117 C1 | FLOORBOARD, front |
| | 120 384 | WASHER, 1/2" lock (4) |
| | 106 265 | WASHER, 1/2" flat (4) |
| | 24 860 R1 | BOLT, 1/2NC x 1" (4) |
| 6 | 196 043 H1 | RAIL (Not used on units equipped with Roll-Over Protection System) (2) |
| | 271 581 | BOLT, 5/8NF x 1-1/4" (4) |
| | 103 325 | WASHER, 5/8" lock (4) |
| | 106 267 | WASHER, 5/8" flat (4) |
| 7 | 884 223 C1 | LADDER (Not used on units equipped with Roll-Over Protection System) |
| | 181 431 | BOLT, 1/2NF x 1-1/2" (4) |
| | 103 323 | WASHER, 1/2" lock (4) |
| | 103 028 | NUT, 1/2" NF hex (4) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

SEAT ASSEMBLY (Not used on units equipped w/R.O.P.S. Cab)

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| | | |
|---|---|---|
| | 882 424 C93 | SEAT ASSEMBLY |
| | 102 634 | NUT (4) |
| | 103 320 | WASHER, lock (4) |
| | | (Consists of the following parts except reference 6 and 7) |
| 1 | 222 191 H1 | BACKREST |
| | 875 515 C1 | SCREW w/WASHER ASS'Y. (3) |
| | 179 839 | SCREW, hex-hd cap (2) |
| | 120 386 | WASHER, flat (2) |
| 2 | 882 910 C1 | CUSHION, seat |
| | 875 515 C1 | SCREW w/WASHER ASS'Y. (2) |
| 3 | | SHELL (Not furnished separately) |
| | 102 634 | NUT (2) |
| | 179 816 | SCREW, hex-hd cap (4) |
| | 103 320 | WASHER, lock (2) |
| 4 | 929 612 C1 | ADJUSTER w/o LEVER (L.H.) |
| 5 | 929 617 C1 | ADJUSTER w/LEVER (R.H.) |
| 6 | 927 597 C3 | BELT, seat (Seat to floor) |
| 7 | 931 059 C1 | BELT, seat (Cap) |



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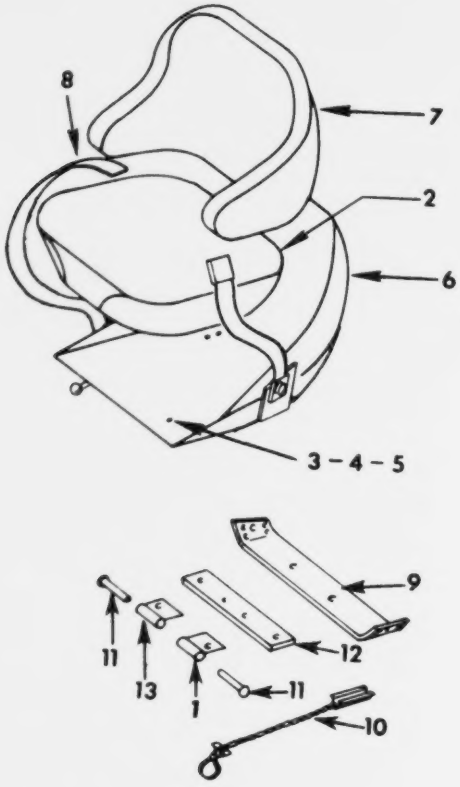
SEAT ASSEMBLY (Used only on units equipped with R.O.P.S. CAB)




*CE-102239A*

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 221 362 H2 | SEAT ASSEMBLY (Order SEAT ASSEMBLY, 934 760 C91) |
| B | 934 760 C91 | SEAT ASSEMBLY (Will work for SEAT ASSEMBLY, 221 362 H2) |
| 1 | 875 512 C1 | HINGE, left hand (SEAT ASSY A) |
| 1 | | HINGE, left hand (Not furnished separately) (SEAT ASSY B) |
| 2 | 222 192 H1 | CUSHION (SEAT ASSY A) |
| 2 | 931 259 C1 | CUSHION (SEAT ASSY B) |
| 3 | 875 515 C1 | BOLT, 3/8NC x 5/8" (SEAT ASSY A) (5) |
| 3 | | BOLT (Not furnished separately) (SEAT ASSY B) |
| 4 | 186 122 | BOLT, 3/8NC x 1" (SEAT ASSY A) (2) |
| 4 | | BOLT (Not furnished separately) (SEAT ASSY B) |
| 5 | 103 340 | WASHER, 3/8 (SEAT ASSY A) (2) |
| 5 | | WASHER (Not furnished separately) (SEAT ASSY B) |
| 6 | 220 190 H1 | SHELL (SEAT ASSY A) |
| 6 | | SHELL (Not furnished separately) (SEAT ASSY B) |
| 7 | 222 191 H1 | BACKREST (SEAT ASSY A) |
| 7 | 931 260 C1 | BACKREST (SEAT ASSY B) |
| 8 | | NOT USED |
| 9 | | BRACKET (Not furnished separately) |
| 10 | 875 511 C91 | CHAIN (SEAT ASSY A) |
| 10 | | CHAIN (Not furnished separately) (SEAT ASSY B) |
| 11 | 875 514 C91 | PIN (SEAT ASSY A) (2) |
| 11 | | PIN (Not furnished separately) (SEAT ASSY B) |
| 12 | | BRACKET (Not furnished separately) |
| 13 | 875 513 C1 | HINGE, left hand (SEAT ASSY A) |
| 13 | | HINGE, left hand (Not furnished separately) (SEAT ASSY B) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **PEDESTAL ASSEMBLY - Continued** |
| 2 | 173 128 | WASHER, 3/8" lock (Pedestal Assy. A) (2) |
| 2 | 114 606 | WASHER, 3/8" lock (Pedestal Assy. B) (2) |
| 2 | 103 321 | WASHER, 3/8" lock (Pedestal C) (4) |
| 3 | 18 253 R1 | NUT, 3/8-16NC lock (Pedestal A) (2) |
| 3 | 18 423 R1 | NUT, 3/8-16NC Esna (Pedestal B) (2) |
| 3 | 21 070 R1 | NUT, 3/8" hex (Pedestal C) (4) |
| 4 | | PIECE, inner (Not furnished separately) |
| 5 | 883 065 C1 | PEDESTAL, lower (Pedestal Assy. A) |
| 5 | 891 598 C1 | PEDESTAL, lower (Pedestal Assy. B) (Order PEDESTAL, 922 229 C91) |
| 5 | 923 382 C1 | PEDESTAL, lower (Pedestal C) |
| 6 | 883 064 C91 | PEDESTAL, upper assembly (Pedestal Assy. A) |
| 6 | 891 597 C1 | PEDESTAL, upper assembly (Pedestal Assy. B) (Order PEDESTAL, 922 229 C91) |
| 6 | 923 380 C91 | PEDESTAL, upper assembly (Pedestal C) |
| 7 | 610 289 C1 | TILT ADJUSTMENT ASSY. (Pedestal Assy. A and C) |
| 7 | | TILT ADJUSTMENT ASSY. (Not furnished separately) (Pedestal B) |
| 8 | 610 292 C1 | SHAFT (Pedestal Assy. A) |
| | 114 496 | NUT, 1/2-20NF jam (2) |
| 8 | | SHAFT (Not furnished separately) (Pedestal B) |
| 8 | 887 760 C1 | SHAFT (Pedestal C) |
| | 145 009 | NUT, 1/2" hex |
| | 181 429 | BOLT, 1/2NF x 1/4" (4) |
| | 103 323 | WASHER, 1/2" lock (4) |
| | 103 028 | NUT, 1/2NF hex (4) |



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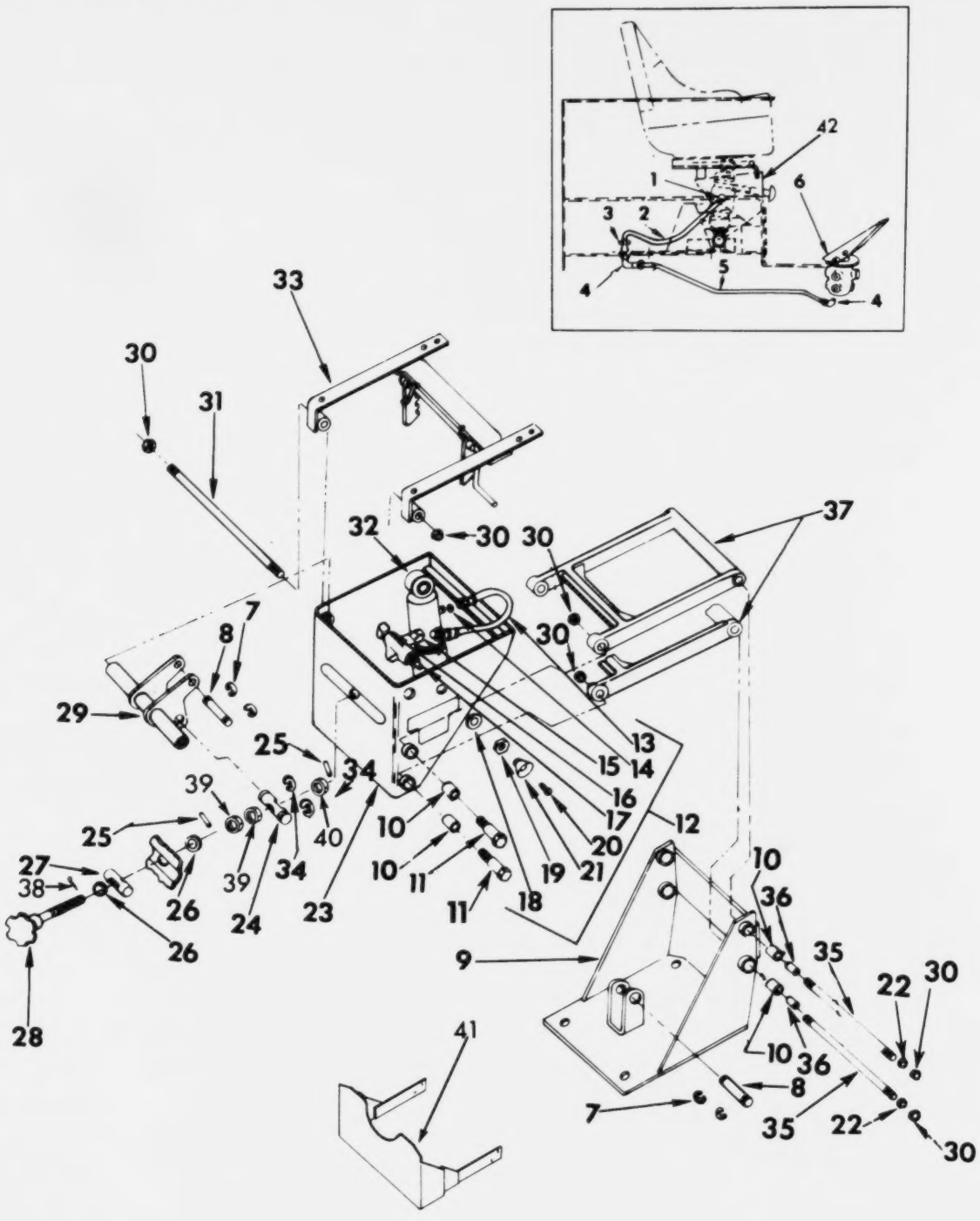
SEAT SUSPENSION (Air Type)

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**SEAT SUSPENSION (Air Type) - Continued**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 888 933 C91 | KIT, Air Seat Suspension (See Note 1) (Consists of the following parts - |
| 1 | 30 402 D | ELBOW w/o NUT |
| | 914 504 C1 | INSERT |
| 2 | | TUBE w/o NUTS - cut length 1/4" O.D. x 18" long - cut from bulk Tube No. 417 196 C2) |
| | 29 889 D | NUT, Tube - 1/4" (2) |
| 3 | 941 041 C1 | CONNECTOR, w/o NUT |
| | 414 504 C1 | INSERT |
| 4 | 252 374 R1 | ELBOW (2) w/o NUT (2) |
| | 414 504 C1 | INSERT (2) |
| 5 | | TUBE w/o NUTS cut length 1/4" O.D. x 60" long - cut from bulk Tube No. 417 196 C2) |
| | 29 898 D | 1/4" tube NUT (2) |
| 6 | | VALVE, treadle (See Treadle Valve in Section 3) |
| 7 | 373 523 R1 | RING, retaining (4) |
| 8 | 615 392 C1 | SHAFT (2) |
| 9 | 887 755 C1 | BASE |
| 10 | 610 266 C1 | BEARING (8) |
| 11 | 887 756 C1 | BOLT, shoulder (4) |
| 12 | 888 079 C91 | AIR CONTROL ASSEMBLY (Composed of items 13 thru 21) |
| 13 | 610 299 C1 | HOSE |
| 14 | 887 757 C1 | GASKET |
| 15 | 183 893 H1 | ELBOW |
| 16 | 146 018 H1 | ELBOW |
| 17 | 887 758 C91 | VALVE, air |
| 18 | 145 412 H1 | WASHER, lock |
| 19 | | PANEL NUT ) |
| 20 | | SCREW ) Order 887 758 C91 |
| 21 | | KNOB ) |
| 22 | 103 323 | WASHER, lock - 1/2" (4) |
| 23 | 887 759 C1 | SUPPORT, upper |
| 24 | 615 393 C1 | SHAFT |
| 25 | 886 286 C1 | PIN, spiral (2) |
| 26 | 120 396 | WASHER |
| 27 | 615 394 C1 | SHAFT |
| 28 | | SCREW, adjusting (#) |
| 29 | 610 293 C91 | ADJUSTMENT, vertical |
| 30 | 145 009 | NUT, hex-lock - 1/2-20 (10) |
| 31 | 887 760 C1 | SHAFT |
| 32 | 887 824 C1 | ABSORBER, air shock |
| 33 | 610 289 C91 | ADJUSTMENT, tilt |
| 34 | 603 570 R1 | RING, retaining (2) |
| 35 | 619 398 C1 | SHAFT (2) |
| 36 | 619 399 C1 | SPACER (4) |
| 37 | 619 497 C91 | KIT, suspension arm (Consists of 2 LOCKWASHER 103 323; 2 NUT 145 009; 1 SHAFT 619 398 C1; 2 SPACER 619 399 C1; § 1 ARM ) |
| 38 | | PIN, cotter (#) |
| 39 | | NUT, jam (#) (2) |
| 40 | | NUT, slotted (#) |
| 41 | 935 871 C1 | GUARD, heel (Also part of KIT, 935 869 C91) |
| | 25 493 R1 | BOLT (4) |
| | 120 214 | WASHER, lock (4) |
| | 25 520 R1 | NUT (4) |
| 42 | 882 028 C91 | SUSPENSION BASE ASSEMBLY (Composed of items 7 thru 41) |
| | 181 427 | BOLT, 1/2NC x 1" (4) |
| | 103 329 | WASHER, lock - 1/2" (4) |
| | 103 028 | NUT, 1/2NF (4) |
| | 892 509 C1 | BAR (Used on units equipped w/Operators Compartment only) |

(#) - Also part of KIT, 892 951 C1.
(§) - Not Furnished Separately.
NOTE 1 - Order on MACHINE ORDER form.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

SEAT SUSPENSION (Air Type) - Continued

| | | |
|---|---|---|
| | 892 508 C1 | CHANNEL (Used on units equipped w/Operators Compartment only) |
| | FGH-107 42 | DRAWING, seat installation |
| | FGH-112 58 | DRAWING, frame rework (For units equipped w/Operators Compartment only) |
| | FGH 146 56 | DRAWING, heel guard installation (Also part of KIT, 935 869 C91) |
| | 892 951 C1 | KIT, adjustment screw (Consists of - § 1 BULLETIN § 2 NUT, jam § 1 NUT, slotted § 1 PIN, cotter § 1 SCREW, adjusting ) |
| | 935 869 C91 | KIT, heelguard (Consists of - 1 BOLT 25 493 R1 1 DRAWING FGH-14656 1 GUARD, heel 935 871 C1 1 LOCK WASHER 120 214 1 NUT 25 520 R1) |
| | 417 196 C2 | TUBE, bulk 1/4" O.D. x 50 ft. (x) |

§ - Not Furnished Separately.

(x) - As Required.



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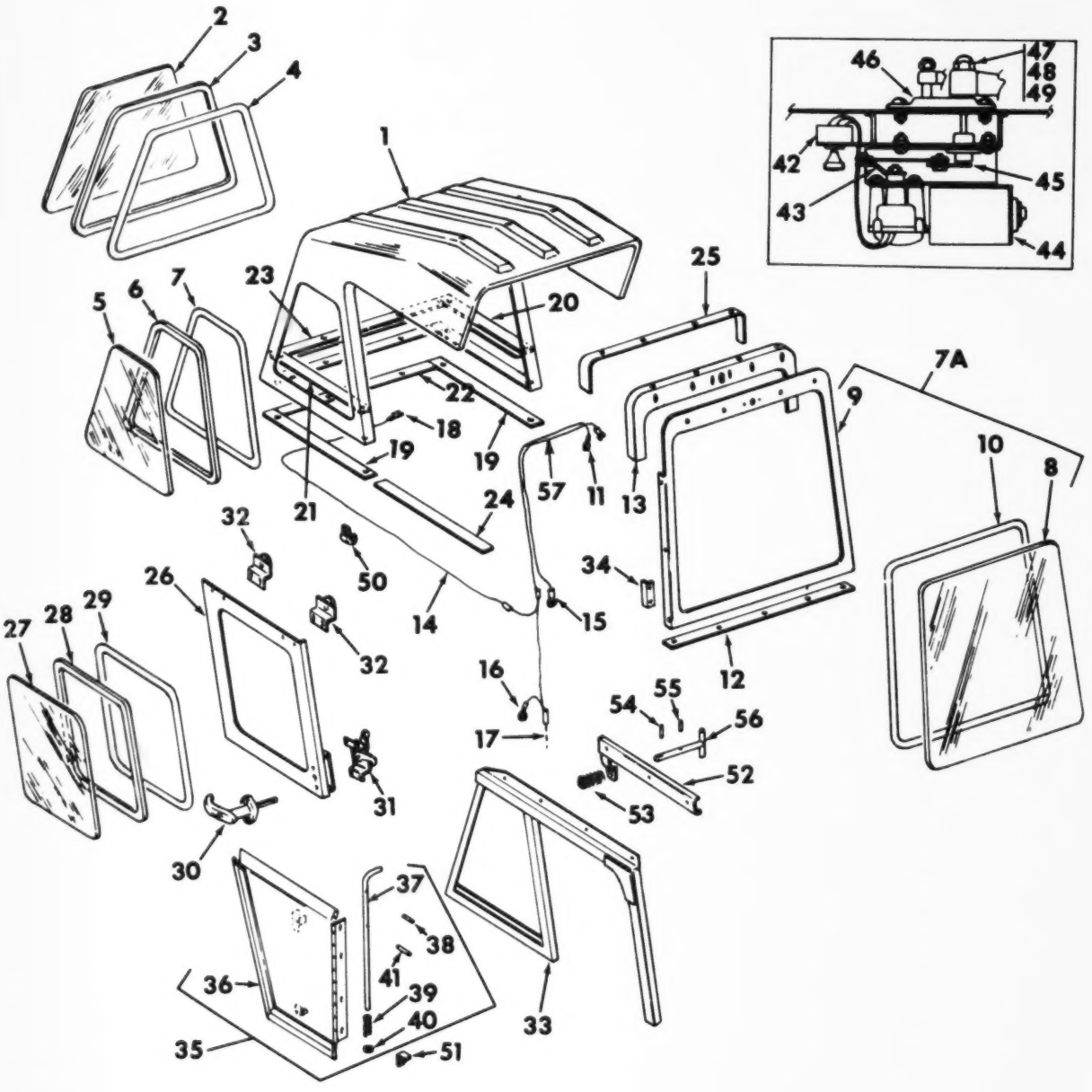
CAB & SIDE ENCLOSURE ATTACHMENT - Continued
(Used only on units equipped w/Operators Compartment)

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**CAB & SIDE ENCLOSURE ATTACHMENT - Continued**
**(Used only on units equipped w/Operators Compartment)**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 890 296 C91 | KIT, cab and Side Enclosure (See Note 1) (Includes items 1 thru 57 except 17) |
| 1 | 889 255 C91 | CAB ASSEMBLY (Composed of<br>§ 1 CAB<br>1 FILLER 183 998 H1<br>2 FILLER 189 903 H1<br>1 MOLDING 178 927 H1<br>2 MOLDING 189 902 H1<br>§ 1 WINDOW 178 926 H1<br>§ 2 WINDOW 189 901 H1) |
| 2 | 178 926 H1 | GLASS, rear |
| 3 | 178 927 H1 | MOLDING, rear window |
| 4 | 183 998 H1 | FILLER, rear window |
| 5 | 189 901 H1 | GLASS, side (2) |
| 6 | 189 902 H1 | MOLDING, side window (2) |
| 7 | 189 903 H1 | FILLER, side window (2) |
| 7A | 889 254 C91 | WINDSHIELD ASSEMBLY |
| | 181 364 | SCREW, 3/8NF x 1" cap (6) |
| | 103 321 | WASHER, 3/8" lock (6) |
| | 103 026 | NUT, 3/8NF hex (6) |
| 8 | 889 252 C1 | GLASS |
| 8 | 889 563 C1 | GLASS (Tinted Windshield) |
| 9 | 889 265 C1 | FRAME, windshield |
| 10 | 889 257 C1 | MOLDING, windshield |
| 11 | | WIRE, front wiper hot feed (Part of Harness 890 275 C2) |
| 12 | 195 071 H1 | RUBBER, front |
| | 181 364 | SCREW, 3/8NF x 1" cap (6) |
| | 103 026 | NUT, 3/8NF hex (6) |
| | 103 321 | WASHER, 3/8" lock (6) |
| | 106 263 | WASHER, 3/8 flat (6) |
| 13 | 889 258 C1 | FRAME, weldment |
| | 103 320 | WASHER, 3/8" lock (4) |
| | 103 025 | NUT, 3/8 hex (4) |
| 14 | 890 275 C3 | HARNESS w/FUSE, 445 635 |
| 15 | | WIRE, connect to "Hot" side parking brake warning switch (part of Harness 890 275 C2) |
| 16 | | WIRE, ground to be applied to parking brake mounting bolt (part of Harness 890 275 C2) |
| 17 | 215 233 H1 | WIRE, (Not part of Kit, 890 296 C91) (Also Listed and Illustrated in Section 8) |
| | | WIRE, rear wiper hot feed (part of Harness 890 275 C2) |
| 19 | 178 930 H1 | MOUNT, rubber (2) |
| | 181 425 | SCREW, 1/2NF x 3/4" cap (4) |
| | 103 028 | NUT, 1/2NF hex (4) |
| | 103 323 | WASHER, 1/2" lock (4) |
| 20 | 188 581 H1 | RETAINER, left hand |
| 21 | 188 580 H1 | RETAINER, right hand |
| 22 | 178 931 H2 | MOUNT, rubber rear |
| | 181 264 | SCREW, 3/8NF x 1" cap (2) |
| | 103 026 | NUT, 3/8NF hex (2) |
| | 103 321 | WASHER, 3/8" lock (2) |
| | 106 263 | WASHER, 3/8" flat (2) |
| 23 | 194 495 H1 | RETAINER, rear |
| 24 | 890 621 C1 | MOUNT, R.H. front rubber |
| 25 | 923 898 C1 | STRIP, rubber |
| 26 | | FRAME, door left hand (Not furnished Separately)(Part of Left Hand Door Assembly, 178 977 H2) |
| 26 | | FRAME, door right hand (Not furnished Separately)(Part of Right Hand Door Assembly 178 987 H2) |
| 27 | 178 979 H1 | GLASS, door (2) |
| 28 | 178 980 H1 | MOLDING, door (2) |
| 29 | 183 991 H1 | FILLER, door (2) |
| 30 | 178 910 H1 | HANDLE, left hand |
| | 110 543 | SCREW, 10-24 x 3/8 oval-hd-slt (2) |

§ - Not Furnished Separately.

Note 1: Order on Machine Order Form.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CAB & SIDE ENCLOSURE ATTACHMENT - Continued** (Used only on units equipped w/Operators Compartment) |
| 31 | 178 969 H1 | LATCH, door right hand |
| 31 | 178 903 H1 | LATCH, door left hand |
| | 187 463 | SCREW, 10-24 x 1/2 Truss-hd-slt (8) |
| 32 | 178 911 H1 | ROLLER (4) |
| | 144 531 | SCREW, 1/4-20 x 1/2 Truss-hd-slt (8) |
| | 103 319 | WASHER, 1/4" lock (8) |
| | 106 261 | WASHER, 1/4 flat (8) |
| 33 | 189 318 H1 | ENCLOSURE, left hand |
| 33 | 189 319 H1 | ENCLOSURE, right hand |
| | 179 793 | SCREW, 1/4NC x 5/8" cap (6) |
| | 103 319 | WASHER, 1/4 lock (24) |
| | 109 084 | NUT, 1/4-20 hex (24) |
| | 137 352 | SCREW, 1/4-20 x 5/8 Truss-hd-slt (14) |
| | 120 572 | SCREW, 1/4-20 x 3/4 Truss-hd-slt (4) |
| 34 | 188 524 H2 | STRIKER (2) |
| | 137 352 | SCREW, 1/4-20 x 5/8 Truss-hd-slt (4) |
| | 103 024 | NUT, 1/4NF hex (4) |
| 35 | 197 729 H1 | DOOR LOWER ASSEMBLY |
| | 181 309 | SCREW, 1/4NF x 1/2" cap (4) |
| | 103 319 | WASHER, 1/4 lock (4) |
| | 106 261 | WASHER, 1/4" flat (4) |
| 36 | 197 730 H1 | DOOR, lower |
| 37 | 197 731 H1 | HANDLE |
| 38 | 143 606 H1 | PIN, roll |
| 39 | 119 138 H1 | SPRING |
| 40 | 103 341 | WASHER, 3/8 flat |
| 41 | 191 264 H1 | PIN, roll |
| 42 | 887 034 C1 | SWITCH, front and rear wipers (2) |
| 43 | | ARM, front wiper crank (See Wiper Motor Assembly in this Section) |
| 44 | | MOTOR, wiper (See Wiper Motor Assembly in this Section) (2) |
| 45 | | SHAFT, wiper arm (See Wiper Motor Assembly in this Section) (2) |
| | | SCREW, 1/4NF x 1/2" cap (2) |
| | 103 319 | WASHER, 1/4 lock (2) |
| | 103 024 | NUT, 1/4NF (2) |
| 46 | 886 255 C1 | KIT, pantograph |
| | 181 309 | SCREW, 1/4NF x 1/2" cap (2) |
| | 103 319 | WASHER, 1/4" lock (2) |
| | 103 024 | NUT, 1/4NF (2) |
| 47 | 924 877 C1 | BLADE, wiper (2) |
| 48 | 890 282 C1 | ARM, rear wiper |
| 49 | 886 254 C1 | ARM, front wiper |
| 50 | 161 043 H1 | "U" CLIP (4) |
| 51 | 197 732 H1 | DOOR, stop |
| | 181 311 | SCREW, 1/4NF x 5/8" cap |
| | 103 319 | WASHER, 1/4" lock |
| | 106 261 | WASHER, 1/4" flat |
| 52 | 191 237 H2 | RETAINER, front R.H. |
| 52 | 191 238 H2 | RETAINER, front L.H. |
| 53 | 191 024 H1 | SPRING, compression (2) |
| 54 | 191 264 H1 | PIN, roll (2) |
| 55 | 191 265 H1 | PIN, roll (2) |
| 56 | 191 023 H1 | HANDLE, tee (2) |
| | 103 341 | WASHER, 1/4" flat (2) |
| 57 | 893 587 C1 | WIRE, wiper ground |
| | 445 635 | FUSE (3 amp) (Part of Harness, 890 275 C3) |
| | 445 684 | PLUG, pipe |
| | 889 621 C1 | MAT, floor |
| | 890 305 C1 | BRACKET, rear switch |
| | 181 365 | SCREW, 3/8NF x 5/8 cap (2) |
| | 103 321 | WASHER, 3/8" lock (2) |
| | 103 026 | NUT, 3/8NF (2) |
| | 891 004 C1 | CAB, modification |
| | FGH-11409 | DRAWING, cab |
| | 890 155 C91 | CAB & SIDE ENCLOSURE (Composed of - 1 CAB ASSEMBLY 889 256 C91; 1 CAB SIDE ENCLOSURE 188 849 H1; 1 DOOR ASSEMBLY LOWER 197 729 H1) |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**CAB & SIDE ENCLOSURE ATTACHMENT - Continued**
**(Used only on units equipped w/Operators Compartment)**

890 155 C91 CAB & SIDE ENCLOSURE
(Composed of - Continued
1 DOOR STOP 197 732 H1
5 FLAT WASHER 106 261
5 LOCK WASHER 103 321
1 RUBBER MOUNTING RIGHT HAND SIDE 890 621 C1
4 SCREW 181 304
1 SCREW 181 311 )

889 256 C91 CAB ASSEMBLY
(Composed of -
1 CAB ASSEMBLY 889 255 C91
6 CAP SCREWS 181 364
1 FRAME 889 258 C1
4 LOCK WASHERS 103 320
6 LOCK WASHERS 103 321
4 NUTS 103 025
6 NUTS 103 026
1 RETAINER 188 580 H1
1 RETAINER 188 581 H1
1 RETAINER 194 495 H1
1 RUBBER STRIP 923 898 C1
1 WINDSHIELD ASSEMBLY 889 254 C1)

188 849 H1 CAB SIDE ENCLOSURES
(Composed of
1 DOOR ASSEMBLY - L.H. 178 977 H2
1 DOOR ASSEMBLY - R.H. 178 987 H2
1 ENCLOSURE L.H. 189 318 H1
1 ENCLOSURE R.H. 189 319 H1
18 FLAT WASHER 106 261
1 FRONT RETAINER R.H. 189 335 H2
32 LOCK WASHER 103 319
32 NUT 109 084
4 ROLLER 178 911 H1
6 SCREW 179 793
4 SCREW 137 352
14 SCREW 120 572
8 SCREW 144 531
2 STRIKER 188 524 H2)

178 977 H2 DOOR, left hand
(Composed of
1 FILLER 183 991 H1
§ 1 FRAME
1 HANDLE 178 910 H1
1 LATCH 178 903 H1
1 MOLDING 178 980 H1
4 SCREW 187 463
2 SCREW 110 543
1 WINDOW 178 979 H1

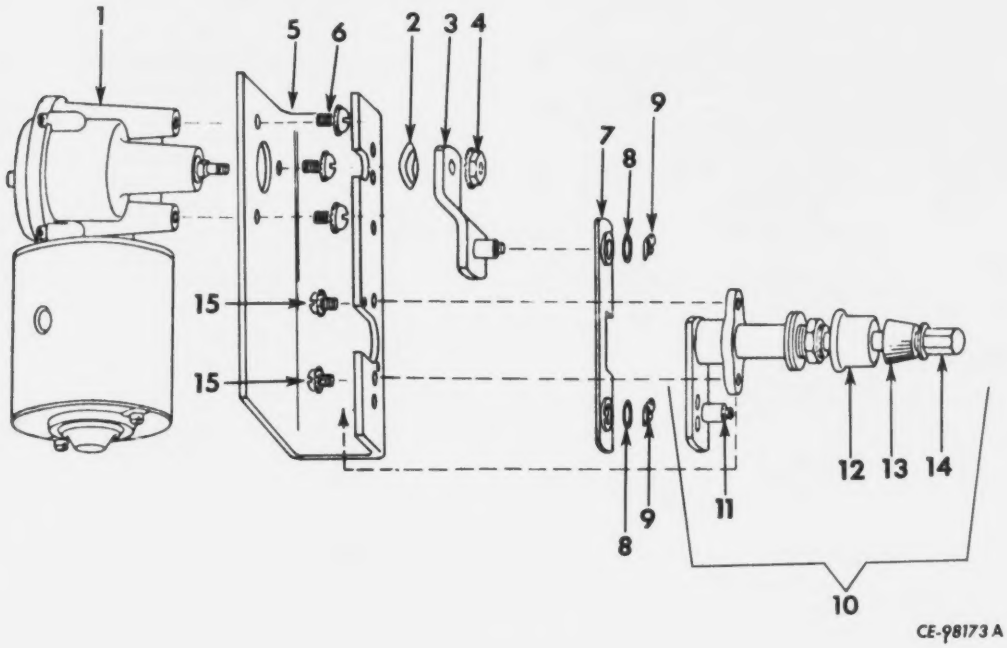
178 987 H2 DOOR, right hand
(Composed of
1 FILLER 183 991 H1
§ 1 FRAME
1 LATCH 178 969 H1
1 MOLDING 178 980 H1
4 SCREW 187 463
1 WINDOW 178 979 H1

189 336 H2 FRONT RETAINER L.H. ASSEMBLY
(Composed of
1 COMPRESSION SPRING 191 024 H1
1 FLAT WASHER 103 341
1 FRONT RETAINER 191 238 H2
1 ROLL PIN 191 264 H1
1 ROLL PIN 191 265 H1
1 TEE HANDLE 191 023 H1)

189 335 H2 FRONT RETAINER R.H. ASSEMBLY
(Composed of
1 COMPRESSION SPRING 191 024 H1
1 FLAT WASHER 103 341
1 FRONT RETAINER 191 237 H2
1 ROLL PIN 191 264 H1
1 ROLL PIN 191 265 H1
1 TEE HANDLE 191 023 H1)

§ – Not Furnished Separately.

WIPER MOTOR ASSEMBLY



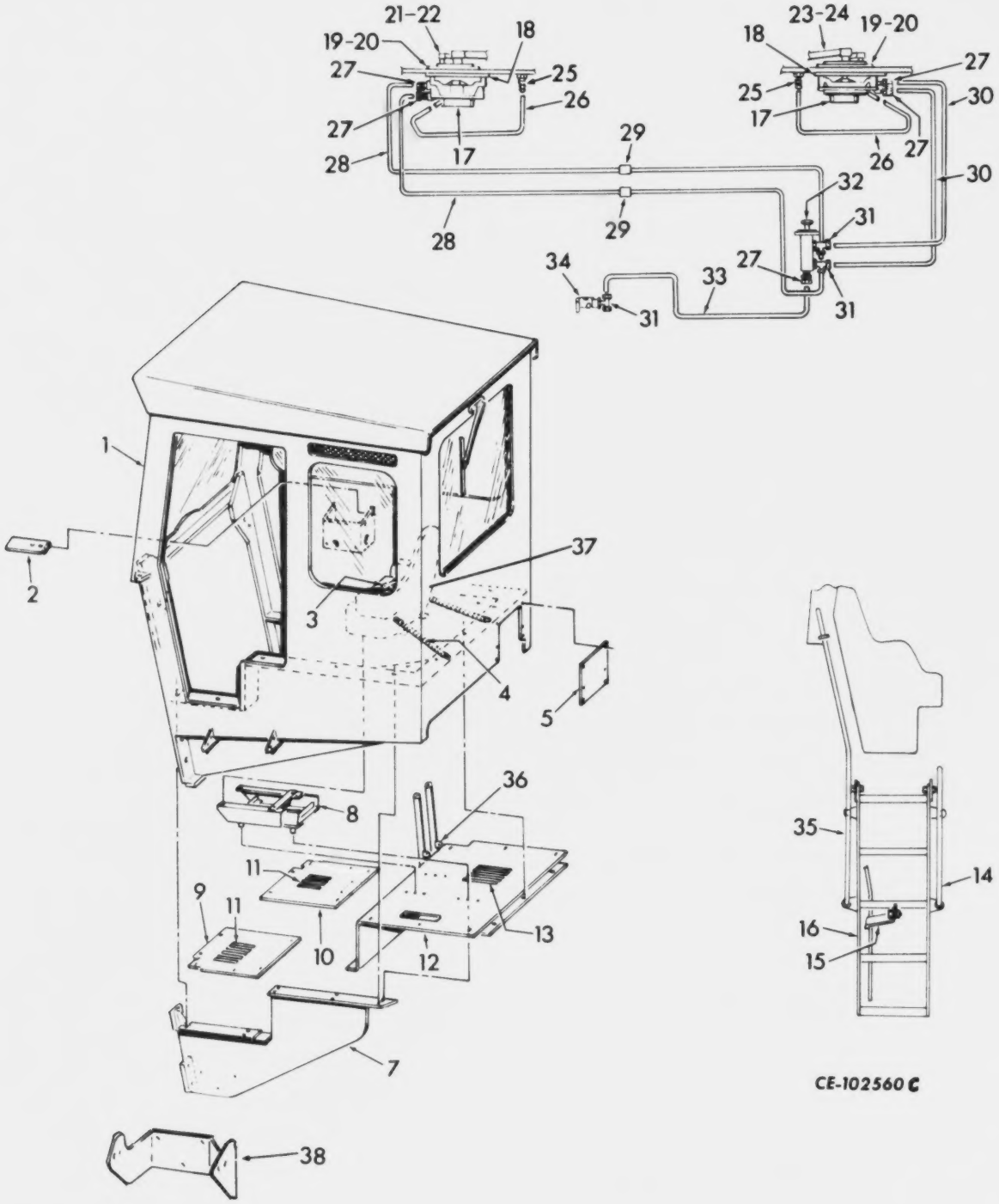

Parts without letters after the description indicates the parts is used on all Wiper Motors listed below: Letters "A" and "B" are used to identify separate Wiper Motors.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 887 033 C2 | WIPER MOTOR ASSEMBLY, front windshield |
| B | 220 033 H1 | WIPER MOTOR ASSEMBLY, rear window |
| 1 | | MOTOR (Not Furnished Separately) |
| 2 | 219 699 R1 | WASHER, spring (Motor A) |
| 3 | 886 257 C1 | ARM, crank (%) |
| 4 | | NUT (Not Furnished Separately) |
| 5 | 923 480 C1 | BRACKET, mounting (Motor A) |
| | 181 313 | BOLT, 1/4 x 1/2NF (2) |
| 5 | 923 480 C1 | BRACKET, mounting (Motor B) |
| 6 | 923 479 C1 | SCREW, rd.-hd. (3) |
| 7 | 260 514 C91 | LINK, connecting |
| 8 | 148 074 R1 | WASHER (2) |
| 9 | 85 037 R1 | CLIP, link to crank and pivot (2) |
| 10 | 886 256 C92 | SHAFT ASSEMBLY (%) (Motor A) |
| 10 | 923 478 C1 | SHAFT ASSEMBLY (Motor B) |
| 11 | 920 359 C1 | PIN (Motor A) |
| 11 | | PIN (Not Furnished Separately) (Motor B) |
| 12 | 920 358 C1 | CAP, rubber (Motor A) |
| 12 | | CAP, rubber (Not Furnished Separately) (Motor B) |
| 13 | 920 357 C1 | NUT, knurled (Motor A) |
| 14 | | NUT, knurled (Not Furnished Separately) (Motor B) |
| 14 | 920 356 C1 | NUT, cap (Motor A) |
| 14 | | NUT, cap (Not Furnished Separately) (Motor B) |
| 15 | | SCREW (Not Furnished Separately) (Motor A) (2) |
| 15 | 923 481 C1 | SCREW (Motor B) (2) |

% - Not furnished as part of WIPER MOTOR ASSEMBLY, 887 033 C2.

MEMORANDA

## ROLL OVER PROTECTIVE STRUCTURE AND RELATED PARTS



| REF. NO. | PART NUMBER | DESCRIPTION | |
|---|---|---|---|
| | | **ROLL OVER PROTECTIVE STRUCTURE AND RELATED PARTS - Continued** | |
| 1 | | CAB, roll over (Refer to R.O.P.S. Cab) | |
| | 9 412 230 | NUT, 1/2" -13 (10) | ) |
| | 9 412 231 | NUT, 5/8" -11 | ) |
| | 27 008 R1 | NUT, 1-1/4" lock (8) | ) |
| | 24 862 R1 | SCREW, 1-1/2" long (10) | ) |
| | 24 875 R1 | SCREW, 2" long | ) U001571 |
| | 26 026 R1 | SCREW, 3" long (2) | ) and up |
| | 25 726 R1 | SCREW, 3-1/4" long (6) | ) C0* and |
| | 25 536 R1 | WASHER, 1/2" flat (20) | ) up |
| | 25 537 R1 | WASHER, 5/8" flat (2) | ) |
| | 25 558 R1 | WASHER, 1-1/4" flat (12) | ) |
| 1 | | CAB, roll over (Refer to R.O.P.S. Cab) | |
| | 452 170 R1 | NUT, 1/2" - 13 (10) | ) |
| | 19 441 R1 | NUT, 5/8" - 11 | ) |
| | 26 071 R1 | NUT, 1-1/4" - 12 (6) | ) |
| | 26 105 R1 | NUT, 1-1/4" - 12 (2) | ) |
| | 24 862 R1 | SCREW, 1-1/2" long (10) | ) U001570 ) and below |
| | 24 875 R1 | SCREW, 2" long | ) |
| | 26 104 R1 | SCREW, 2-3/4" long (2) | ) C0* and |
| | 23 321 R1 | SCREW, 3-1/2" long (6) | ) below |
| | 120 389 | WASHER, 17/32" flat (20) | ) |
| | 446 239 | WASHER, 5/8" flat (2) | ) |
| 2 | 927 836 C1 | SUPPORT, wiper control | |
| | 179 795 | SCREW, hex-hd cap (4) | |
| | 103 319 | WASHER, lock (4) | |
| 3 | 931 159 C1 | BELT, seat | |
| 4 | 927 597 C3 | BELT, (Floor to Seat) seat | |
| 5 | 926 208 C1 | PLATE, back access hole | |
| | 26 110 R1 | NUT, Esna (6) | |
| | 25 222 R1 | SCREW, hex-hd cap (6) | |
| | 25 532 R1 | WASHER, flat (12) | |
| 6 | | NOT USED | |
| 7 | 926 792 C1 | SUPPORT (L.H.) | |
| | 9 412 231 | NUT (3) | ) U001571 |
| | 24 878 R1 | SCREW, hex-hd cap (3) | ) and up ) C0* and |
| | 25 547 R1 | WASHER, flat (6) | ) and up |
| | 19 441 R1 | NUT (3) | ) |
| | 24 878 R1 | SCREW, hex-hd cap (3) | ) U001570 ) and below |
| | 118 669 | WASHER, flat (6) | ) C0* and ) below |
| 7 | 926 793 C1 | SUPPORT, right hand (Not used on H-100C Military) | |
| 7 | M1 134 371 C1 | SUPPORT, right hand (Used only on H-100C Military) | |
| | 9 412 231 | NUT (3) | ) U001571 |
| | 24 878 R1 | SCREW, hex-hd cap (3) | ) and up ) C0* and |
| | 25 547 R1 | WASHER, flat (6) | ) up |
| | 19 441 R1 | NUT (3) | ) |
| | 24 878 R1 | SCREW, hex-hd cap (3) | ) U001570 ) and below |
| | 118 669 | WASHER, flat (6) | ) C0* and ) below |
| 8 | 922 874 C92 | BASE, seat | |
| 9 | 926 833 C1 | PLATE, L.H. front floor | |
| | 9 412 230 | NUT (4) | ) U001571 |
| | 24 862 R1 | SCREW, hex-hd cap (4) | ) and up ) |
| | 25 536 R1 | WASHER, flat (8) | ) C0* and |
| | 452 170 R1 | NUT (4) | ) up |
| | 24 862 R1 | SCREW, hex-hd cap (4) | ) ) U001570 |
| | 120 389 | WASHER, flat (8) | ) and below ) C0* and ) below |
| 10 | 926 841 C1 | PLATE, R.H. front floor | |
| | 9 412 230 | NUT (4) | ) U001570 |
| | 24 862 R1 | SCREW, hex-hd cap (4) | ) and up ) |
| | 25 536 R1 | WASHER, flat (8) | ) C0* and |
| | 452 170 R1 | NUT (4) | ) and up |
| | 24 862 R1 | SCREW, hex-hd cap (4) | ) ) U001570 |
| | 120 389 | WASHER, flat (8) | ) and below ) C0* and ) below |
| 11 | 927 704 C1 | MAT, front floor | |

* - Serial Number Not Available.

| REF. NO. | PART NUMBER | DESCRIPTION | |
|---|---|---|---|
| | | **ROLL OVER PROTECTIVE STRUCTURE AND RELATED PARTS - Continued** | |
| 12 | 927 310 C1 | PLATFORM, seat (Not used on units equipped w/Auxiliary Instruments, Air Seat Suspension and H-100C Military) | |
| | 9 412 230 | NUT (3) | ) U001571 |
| | 24 862 R1 | SCREW, hex-hd cap (3) | ) and up ) |
| | 25 536 R1 | WASHER, flat (6) | ) CO* and ) up ) |
| | 452 170 R1 | NUT (3) | ) U001570 |
| | 24 862 R1 | SCREW, hex-hd cap (3) | ) and below ) |
| | 120 389 | WASHER, flat (6) | ) CO* and ) below |
| 12 | 929 497 C1 | PLATFORM, seat (Used only on units equipped w/Auxiliary Instruments) | |
| | 9 412 230 | NUT (3) | ) U001571 |
| | 24 862 R1 | SCREW, hex-hd cap (31) | ) and up ) |
| | 25 536 R1 | WASHER, flat (6) | ) CO* and up |
| | 452 170 R1 | NUT (3) | ) U001570 |
| | 24 862 R1 | SCREW, hex-hd cap (3) | ) and below ) |
| | 120 389 | WASHER, flat (6) | ) CO* and ) below |
| 12 | 929 511 C1 | PLATFORM, seat (Used only on units equipped w/Air Seat Suspension) | |
| | 9 412 230 | NUT (3) | ) U001571 |
| | 24 862 R1 | SCREW, hex-hd cap (3) | ) up ) |
| | 25 536 R1 | WASHER, flat (6) | ) CO* and up ) |
| | 452 170 R1 | NUT (3) | ) U001570 |
| | 24 862 R1 | SCREW, hex-hd cap (3) | ) below ) |
| | 120 389 | WASHER, flat (6) | ) CO* and ) below |
| 12 | M1 134 397 C1 | PLATFORM, seat (Used only with H-100C Military) | |
| | 9 412 230 | NUT (3) | |
| | 24 862 R1 | BOLT (3) | |
| | 25 536 R1 | WASHER, flat (6) | |
| 13 | 927 774 C1 | MAT, seat deck | |
| 14 | 926 196 C1 | HANDRAIL | |
| 15 | 926 199 C1 | SUPPORT, ladder | |
| | 9 412 230 | NUT, Esna (2) | ) U001571 |
| | 24 863 R1 | SCREW, hex-hd cap (2) | ) and up ) |
| | 25 536 R1 | WASHER, flat | ) CO* and up ) |
| | 427 170 R1 | NUT, Esna (4) | ) U001570 ) and below ) |
| | 24 863 R1 | SCREW, hex-hd cap (4) | ) U001570 ) and below |
| | 120 389 | WASHER, flat | ) CO* and ) below |
| 16 | 928 953 C2 | LADDER | |
| | 9 412 230 | NUT, Esna (4) | ) U001571 ) and up |
| | 24 862 R1 | SCREW, hex-hd cap (4) | ) CO* and ) up |
| | 452 170 R1 | NUT, Esna (4) | ) U001570 ) and below |
| | 24 862 R1 | SCREW, hex-hd cap (4) | ) CO* and ) below |
| 17 | | MOTOR, wiper (Refer to Wiper Motor (Air Operated) (# #) | |
| 18 | 927 525 C1 | BAR, spacer (# #) | |
| 19 | 132 926 | SCREW, round-hd slotted (#) (4) | |
| 20 | 121 801 | WASHER, tooth (#) (4) | |
| 21 | 926 863 C1 | WIPER ARM, rear (#) | |
| 22 | 339 440 C91 | BLADE, rear (#) | |
| 23 | 924 487 C1 | WIPER ARM, front | |
| 24 | 924 486 C91 | BLADE, front | |
| 25 | 61 181 H | CONNECTOR (# #) | |
| 26 | 163 884 H1 | HOSE, exhaust (# #) | |
| 27 | 29 901 D | CONNECTOR (#) ($) (5) | |
| | 414 504 C1 | INSERT (#) ($) (5) | |
| 28 | | TUBE w/o NUT, cub length 1/4" O.D. x 104" long-cut from bulk TUBE, 417 196 C1 (Used w/CAB, 925 923 C91 and 925 923 C92) (2) | |
| 28 | 929 365 C1 | TUBE, w/o NUTS (Used on machines w/ CAB, 939 858 C91 and 941 885 C91) (2) | |
| | 29 898 D | NUT, tube (4) | |
| 29 | 926 758 C1 | CLIP, hose (Used w/CAB, 925 923 C91 and 925 923 C92) (14) | |

($) - Three used on units not equipped w/Rear Wiper.

* - Serial Number Not Available.

(#) - Standard on machines w/CAB, 925 923 C91, 925 923 C92 and used on units equipped w/Rear Wiper Attachment.

(# #) - Two used w/CAB, 925 923 C91 and 925 923 C92 and units equipped w/Rear Wiper.

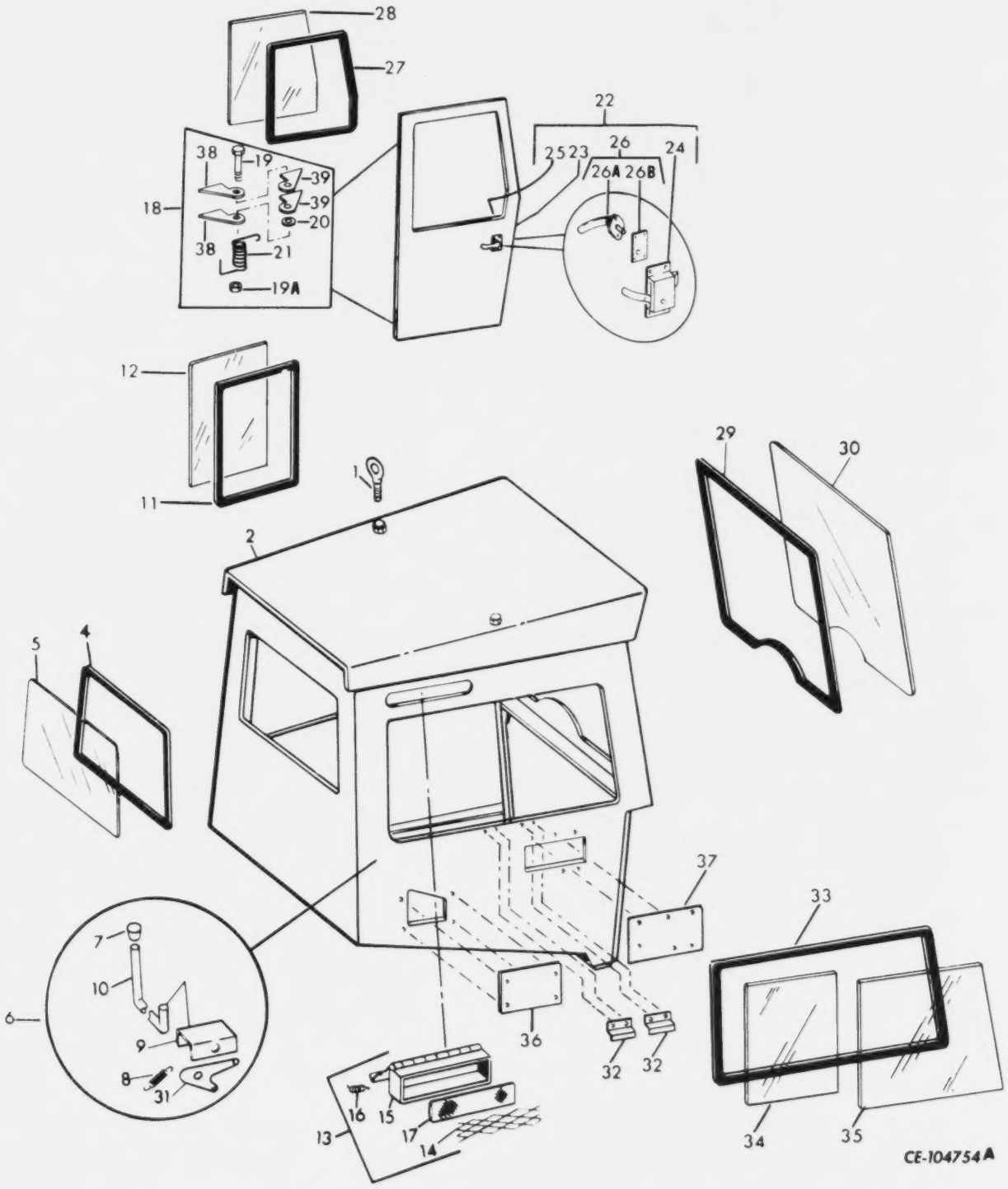
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **ROLL OVER PROTECTIVE STRUCTURE AND RELATED PARTS - Continued** |
| 29 | 929 363 C1 | CLIP (Used w/CAB 939 858 C91 and 941 885 C91) |
| 30 | | TUBE w/o NUT, cut length 1/4" O.D. x 28" long-cut from bulk TUBE, 417 196 C1 (Used w/CAB, 925 923 C91 and 925 923 C92) (2) |
| 30 | 929 625 C1 | TUBE, w/o NUTS (Used w/CAB, 939 858 C91 and 941 885 C91) (2) |
| | 29 898 D | NUT, tube (4) |
| 31 | 95 791 H | TEE (#) (3) |
| | 414 504 C1 | INSERT (#) (3) |
| 32 | 926 724 C1 | VALVE w/KNOB, 935 452 C1 |
| 33 | | TUBE w/o NUT, cut length 1/4" O.D. x 10" long-cut from bulk TUBE, 417 196 C1 |
| 34 | | VALVE, boom kick-out (Refer to Air Valve) |
| 35 | 926 201 C1 | HANDRAIL |
| | 271 581 | SCREW (5) |
| | 103 325 | WASHER, lock (5) |
| 36 | 208 914 H1 | LUG (2) |
| 37 | | SEAT ASSEMBLY (Refer to SEAT ASSEMBLY) |
| 38 | 927 805 C1 | SUPPORT |
| | 9 412 230 | NUT, Esna (3) ) U001571 and up |
| | 24 863 R1 | SCREW, hex-hd cap (3) ) C0* and up |
| | 452 170 R1 | NUT, Esna (3) ) U001570 and below |
| | 24 863 R1 | SCREW, hex-hd cap (3) ) C0* and below |
| | 929 363 C1 | CLIP (Control Valve to Kick-Out Valve) (10) |
| | 935 452 C1 | KNOB (Part of VALVE, 926 724 C1) |
| | 928 420 C1 | PLATE, serial number |
| | 928 427 C1 | RIVET, drive (2) |
| | 417 196 C1 | TUBING, bulk 1/4" O.D. x 50 feet long (x) |

(#) Standard on machines w/CAB, 925 923 C91, 925 923 C92 and used on units equipped w/Rear Wiper Attachment.

* Serial Number Not Available.

(x) As Required.

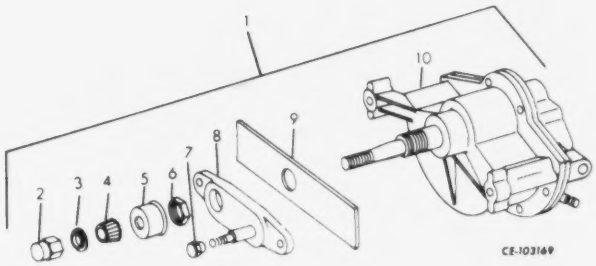
R.O.P.S. CAB
(Roll-Over Protective Structure)
C001720 and below
U001680 and below



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **R.O.P.S. CAB - Continued (Roll-Over Protective Structure) U001680 and below C001720 and below** |
| | 925 923 C91 | CAB ASSEMBLY, roll over (Order ROLL OVER CAB ASSY, 939 858 C91) |
| | 925 923 C92 | CAB ASSEMBLY, roll over (Order ROLL OVER CAB ASSY, 939 858 C91) (Consists of the following parts - |
| 1 | 926 985 C1 | HOOK, lifting (2) |
| 2 | | CANOPY (Not furnished separately) |
| 4 | | MOLDING (Not furnished separately) |
| 5 | 929 304 C1 | GLASS |
| 6 | 927 131 C91 | HOLD BACK ASSEMBLY (2) |
| 7 | 927 132 C1 | CAP, handle (2) |
| 8 | 926 987 C1 | SPRING (2) |
| 9 | | BRACKET (Not furnished separately) (2) |
| 10 | | ROD (Not furnished separately) (2) |
| 11 | | MOLDING (Not furnished separately) (2) |
| 12 | 929 303 C1 | GLASS, side |
| 13 | 926 986 C91 | VENT ASSEMBLY (2) |
| 14 | 926 988 C1 | SCREEN (2) |
| 15 | | FRAME (Not furnished separately) |
| 16 | 926 987 C1 | SPRING (4) |
| 17 | | COVER, weatherseal (Not furnished separately) |
| 18 | 935 516 C91 | HINGE ASSEMBLY, door (4) |
| 19 | 24 844 R1 | BOLT (4) |
| 19A | 9 413 979 | NUT, lock (Used w/CAB ASSEMBLY, 925 923 C92) (4) |
| 20 | 927 129 C1 | BEARING (Used w/CAB ASSEMBLY 925 923 C91) (4) |
| 21 | 935 517 C1 | SPRING, door (4) |
| 22 | 929 323 C91 | DOOR ASSEMBLY (L.H.) (Used w/CAB ASSEMBLY, 925 923 C92) |
| 22 | 935 521 C91 | DOOR ASSEMBLY (L.H.)(Used w/CAB ASSEMBLY, 925 923 C92) |
| 23 | | FRAME, door (Order DOOR ASSEMBLY, 935 521 C91) (Used w/CAB ASSEMBLY, 925 923 C92) |
| 23 | | FRAME, door (Order DOOR ASSEMBLY, 929 323 C91) (Used w/CAB ASSEMBLY, 925 923 C91) |
| 24 | 928 827 C1 | HANDLE, door |
| | 25 970 R1 | SCREW (2) |
| 25 | 927 134 C1 | STAY |
| 26 | 927 135 C91 | LATCH ASSEMBLY (L.H.) |
| | 25 232 R1 | SCREW (4) |
| | 25 520 R1 | NUT (4) |
| 26A | 927 136 C91 | LATCH (L.H.) |
| 26B | 928 802 C1 | PLATE, backing |
| 27 | | MOLDING (Not furnished separately) |
| 28 | 929 302 C1 | GLASS, door |
| 29 | | MOLDING (Not furnished separately) |
| 30 | 929 313 C1 | GLASS, windshield |
| 31 | | ANGLE (Not furnished separately) |
| 32 | 929 305 C1 | BRACKET, inner window (4) |
| 32 | 929 308 C1 | BRACKET, outer window (4) |
| | 179 797 | BOLT, 1/4-20 x 1" (8) |
| | 103 319 | WASHER, 1/4" lock (8) |
| | 109 084 | NUT, 1/4-20 hex (8) |
| 33 | | MOLDING (Not furnished separately) |
| 34 | 929 272 C1 | GLASS, sliding right |
| 35 | 929 274 C1 | GLASS, stationary right |
| 36 | 929 307 C1 | COVER, right rear |
| | 179 795 | BOLT, 1/4-20 x 3/4" (4) |
| | 19 592 R1 | NUT, 1/4-20 Esna (4) |
| 37 | 929 326 C1 | COVER, heater |
| | 179 795 | BOLT, 1/4-20 x 3/4" |
| | 19 595 R1 | NUT, 1/4-20 Esna |
| | 24 839 R1 | BOLT, 3/8-16 x 3/4" (5) |
| | 18 423 R1 | NUT, 3/8-16 Esna (5) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **R.O.P.S. CAB - Continued (Roll-Over Protective Structure) U001680 and below C001720 and below** |
| 38 | 935 518 C1 | HINGE PART, cab (Used w/CAB ASSEMBLY, 925 923 C92) (8) |
| 39 | 935 519 C1 | HINGE PART, door (Used w/CAB ASSEMBLY, 925 923 C92) (8) |
| | 929 332 C92 | CAB ASSEMBLY (Composed of - |
| | | 1 COVER 929 307 C1 |
| | | 1 COVER 929 326 C91 |
| | | 1 DOOR 929 323 C91 |
| | | 1 GLASS 929 302 C1 |
| | | 1 GLASS 929 303 C1 |
| | | 1 GLASS 929 304 C1 |
| | | 1 GLASS 929 313 C1 |
| | | 4 HINGE ASSEMBLY 935 516 C91 |
| | | 1 HOLD BACK 927 131 C91 |
| | | 2 HOOK 926 985 C1 |
| | | 2 VENT 926 986 C92 |
| | | 1 WINDOW 929 333 C91) |
| | 929 333 C91 | WINDOW, right assembly (Composed of - |
| | | 4 BRACKET 929 305 C1 |
| | | 4 BRACKET 929 308 C1 |
| | | 1 GLASS 929 272 C1 |
| | | 1 GLASS 929 274 C1 |
| | | § 1 MOLDING ) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **WIPER MOTOR ASSEMBLY (Air Operated) (Used only on units equipped w/Roll-Over Protective Structure)** |
| 1 | 926 725 C91 | MOTOR ASSEMBLY, wiper (Air Operated) (2) |
| | 25 222 R1 | SCREW, hex-hd cap (4) |
| | 103 319 | WASHER, lock (4) |
| 2 | 339 544 C1 | NUT, cap |
| 3 | 138 542 | WASHER, lock |
| 4 | 966 742 R1 | DRIVER, knurled |
| 5 | 426 961 C1 | SHIELD, rain |
| 6 | 426 960 C1 | NUT |
| 7 | 927 843 C1 | NUT, cap |
| 8 | 436 440 C1 | SPACER ASSEMBLY, outer |
| 9 | 436 439 C1 | GASKET |
| 10 | | MOTOR, wiper (Not furnished separately) |



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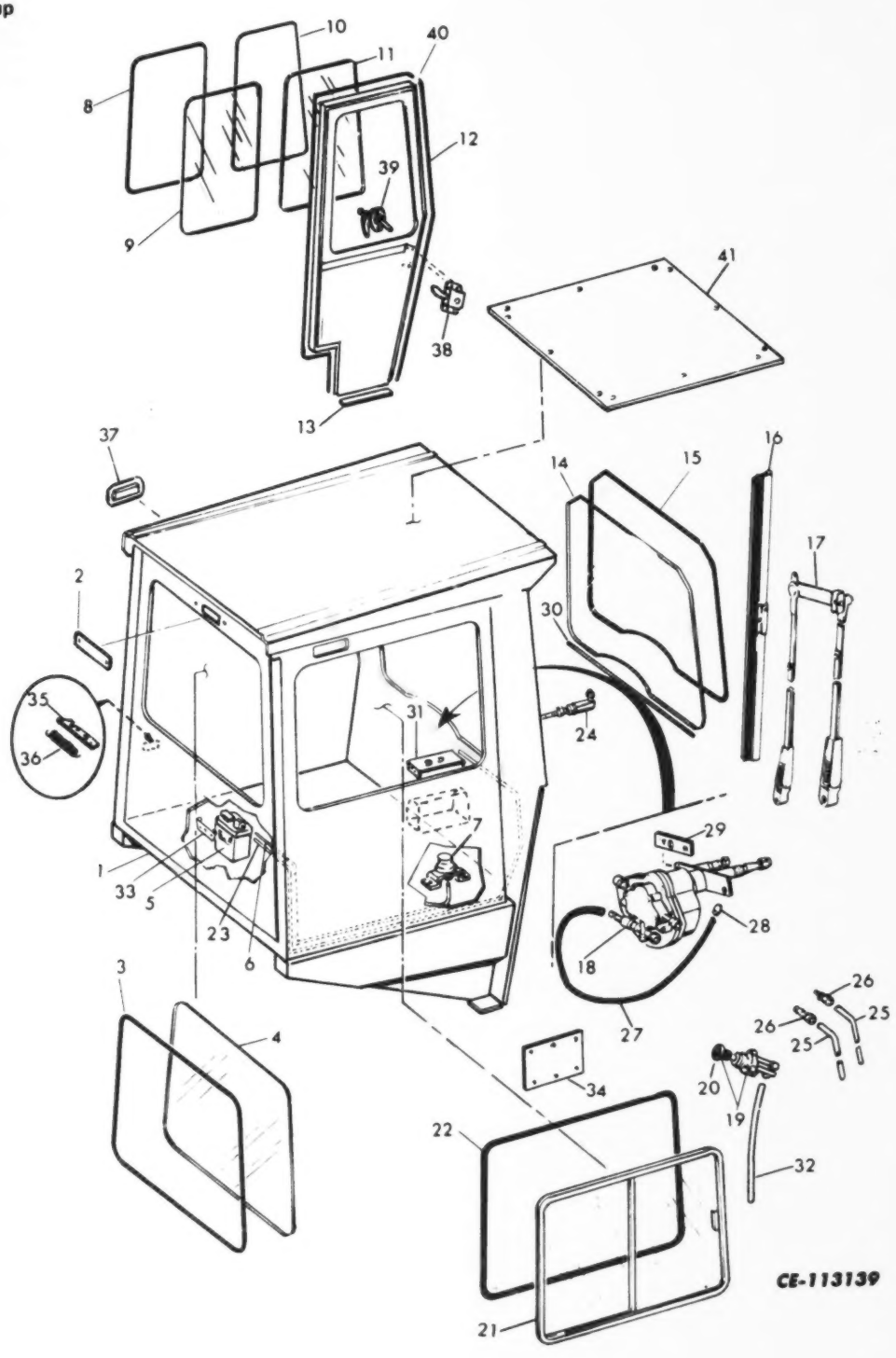
**R.O.P.S. CAB**
**U001681 and up**
**C001721 and up**



| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| R.O.P.S. CAB - Continued<br>U001681 and up<br>C001721 and up | | |
| A | 939 858 C92 | CAB ASSEMBLY, roll over (Not used on H-100C Military) |
| B | 941 885 C92 | CAB ASSEMBLY, roll over (Noise Suppression) |
| C | M1 134 380 C91 | CAB ASSEMBLY, roll over (Used on H-100C Military)<br>(Consists of the following parts - |
| 1 | 941 800 C2 | CAB ASSEMBLY (A) |
| 1 | 941 884 C2 | CAB ASSEMBLY (B & C) |
| | 24 862 R1 | BOLT, hex-hd (1/2" NC x 1-1/2" long) (12) |
| | 24 875 R1 | BOLT, hex-hd (5/8"NC x 2" long) |
| | 25 726 R1 | BOLT, hex-hd (1-1/4"NC x 3-1/4" long) (6) |
| | 26 026 R1 | BOLT, hex-hd (1-1/4"NC x 3" long) (4) |
| | 25 536 R1 | WASHER, hardened (1/2") (24) |
| | 25 537 R1 | WASHER, hardened (5/8") |
| | 25 558 R1 | WASHER, hardened (1-1/4") (16) |
| | 27 008 R1 | NUT, hex (1-1/4"NC) (10) |
| | 9 412 230 | NUT, lock (1/2"NC) (12) |
| | 9 412 231 | NUT, hex (5/8"NC) |
| | 132 926 | SCREW (2) |
| | 121 801 | WASHER (2) |
| | FGH-13 650 | DRAWING, cab installation |
| 2 | 1 106 478 C1 | PLATE, cover (Replaces 939 355 C1) |
| | 22 379 R1 | SCREW, 10-24NC x 1" long (2) |
| | 24 860 R1 | BOLT, 1/2"NC x 1" long |
| | 19 302 R1 | NUT, jam (2) |
| | 25 526 R1 | NUT, 1/2"NC |
| 3 | 941 865 C1 | SEAL, rubber |
| 4 | 941 860 C1 | GLASS, rear window |
| 5 | 940 459 C91 | TANK, washer |
| 6 | | HOSE (Cut length 7/32"ID x 72" long from bulk HOSE, 940 454 C1) |
| | 929 417 C1 | CLIP (3) |
| 7 | 940 458 C1 | PUMP, feet |
| 8 | 941 864 C1 | SEAL, rubber |
| 9 | 941 859 C1 | GLASS, left hand side |
| 10 | 941 683 C1 | SEAL, rubber |
| 11 | 941 858 C1 | GLASS, door |
| 12 | 941 867 C1 | SEAL, weather |
| 13 | 941 872 C1 | SEAL, door |
| 14 | 941 857 C1 | GLASS, windshield |
| 15 | 941 862 C1 | SEAL, rubber |
| 16 | | BLADE, wiper (%) |
| 17 | | ARM, wiper (%) |
| 18 | | MOTOR, wiper (Air Operated) (Refer to WIPER MOTOR ASSY (Air Operated) ) |
| | 436 737 | SCREW (2) |
| | 178 378 | WASHER, lock (2) |
| 19 | | VALVE, wiper control w/KNOB (%) |
| 20 | | KNOB, control valve (%) |
| 21 | 941 861 C1 | WINDOW, sliding |
| 22 | 941 866 C1 | SEAL, rubber |
| 23 | | HOSE (Cut length 5/32"ID x 87" long from bulk HOSE, 940 455 C1) |
| 24 | 940 457 C91 | NOZZLE, washer |
| 25 | | TUBE, wiper control valve to wiper motor (%) (2) |
| 26 | | CONNECTOR (%) (4) |
| 27 | | HOSE, exhaust (%) |
| 28 | | CONNECTOR (%) |
| 29 | | BAR, spacer (%) |
| 30 | 941 801 C1 | SEAL, rubber |
| 31 | 927 836 C1 | SUPPORT |
| | 25 522 R1 | BOLT (4) |
| | 103 319 | WASHER, lock (4) |
| 32 | | TUBE, wiper control to boom kick-out valve (%) |
| 33 | 940 456 C1 | SUPPORT, washer |
| | 25 483 R1 | BOLT (4) |
| | 25 532 R1 | WASHER, hardened (4) |
| | 25 519 R1 | NUT (2) |
| 34 | 941 856 C1 | PLATE, cover |
| | 24 840 R1 | BOLT (5) |
| | 25 544 R1 | WASHER (5) |
| | 25 522 R1 | NUT (5) |
| 35 | 935 270 C1 | BAR, door stay |
| 36 | 935 268 C1 | SPRING |
| 37 | 939 357 C1 | VENTILATOR, 2-way (2) |
| 38 | 935 259 C1 | LATCH, door |
| | 935 389 C1 | RIVET (4) |
| 39 | 940 026 C1 | HANDLE, door |
| | 171 730 | SCREW (2) |

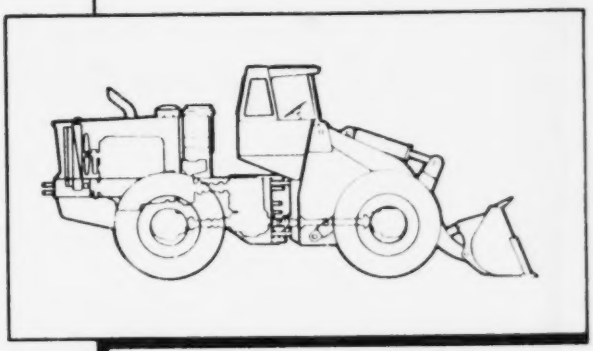
(%) - Refer to ROLL OVER PROTECTIVE STRUCTURE & RELATED PARTS.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **R.O.P.S. CAB - Continued** |
| | | **U001681 and up** |
| | | **C001721 and up** |
| 40 | 941 869 C1 | DOOR, L.H. |
| | 935 383 C1 | PIN, hinge (2) |
| | 935 267 C1 | SPRING (2) |
| | 25 544 R1 | WASHER, hardened (2) |
| | 103 373 | PIN, cotter (2) |
| 41 | 935 405 C1 | PLATE, roof cover (B & C) |
| | 941 879 C1 | INSULATION, top front (B & C) |
| | 941 880 C1 | INSULATION, top rear (B & C) |
| | 941 881 C1 | INSULATION, door (B & C) |
| | 941 882 C1 | INSULATION, left side (B & C) |
| | 941 883 C1 | INSULATION, rear panel (B & C) |
| | 941 887 C1 | INSULATION, right side (B & C) |
| | 1 101 698 C1 | INSULATION, top (B & C) |
| | 1 101 699 C1 | INSULATION, top (B & C) |
| | 940 454 C1 | HOSE, bulk 7/32"ID x 50 ft. (X) |
| | 940 455 C1 | HOSE, bulk 5/32"ID x 50 ft. (X) |

(X) - As Required.

# SECTION 14

# SUSPENSION



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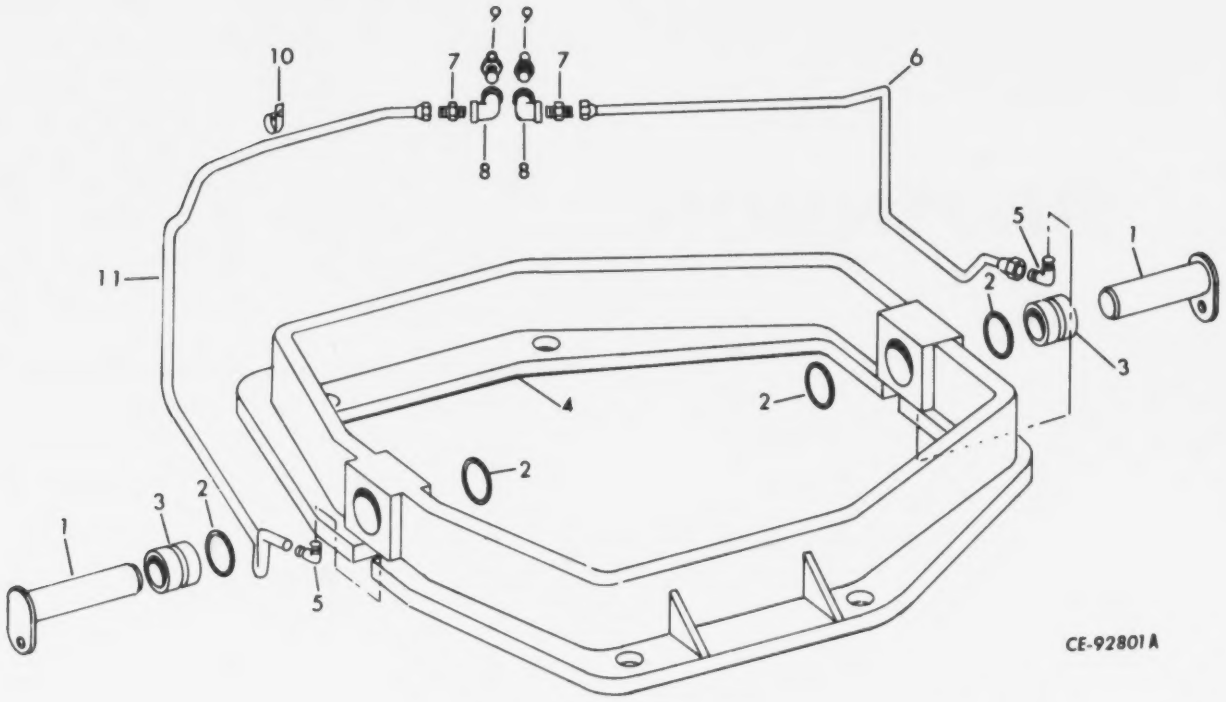
# SUSPENSION

BOLSTER




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 179 818 H1 | PINLOCK (2) |
| | 24 884 R1 | SCREW, 3/4"NC (Used w/ WASHER 932 279 C1) (2) |
| | 25 851 R1 | SCREW, 5/8"NF (Used w/ WASHER, 25 537 R1) (2) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) (2) |
| | 25 537 R1 | WASHER, flat (Used w/SCREW, 25 851 R1) (2) |
| 2 | 181 614 H1 | CORD, ring (4) |
| 3 | 147 867 H1 | BUSHING (2) |
| 4 | 199 224 H3 | BOLSTER w/two ELBOW and two BUSHING, 147 867 H1 |
| 5 | 109 462 | FITTING, lube (2) U001591 and below C0* and below |
| 5 | 9 402 862 | ELBOW (2) U001592 and up C0* and up |
| 6 | 936 035 C1 | TUBE w/NUTS U001592 and up C0* and up |
| | 9 403 486 | NUT, tube (2) |
| 7 | 9 402 706 | CONNECTOR U001592 and up C0* and up |
| 8 | | ELBOW (Order BOLSTER, 199 224 H3) (2) U001592 and up C0* and up |
| 9 | 109 461 | FITTING, lube (2) U001592 and up C0* and up |
| 10 | 140 578 | CLAMP, closed U001592 and up C0* and up |
| | 25 520 R1 | NUT |
| | 25 533 R1 | WASHER, flat (2) |
| 11 | 936 036 C1 | TUBE w/NUTS U001592 and up C0* and up |
| | 9 403 486 | NUT, tube (2) |
| | 156 087 H1 | SPACER (4) |

* - Serial Number Not Available.



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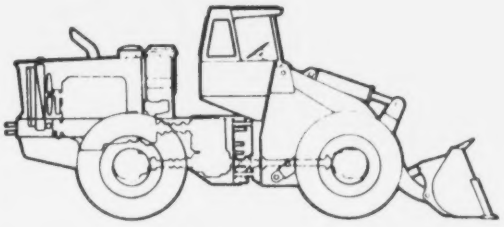
# SECTION 15

# WHEELS & TRACTION



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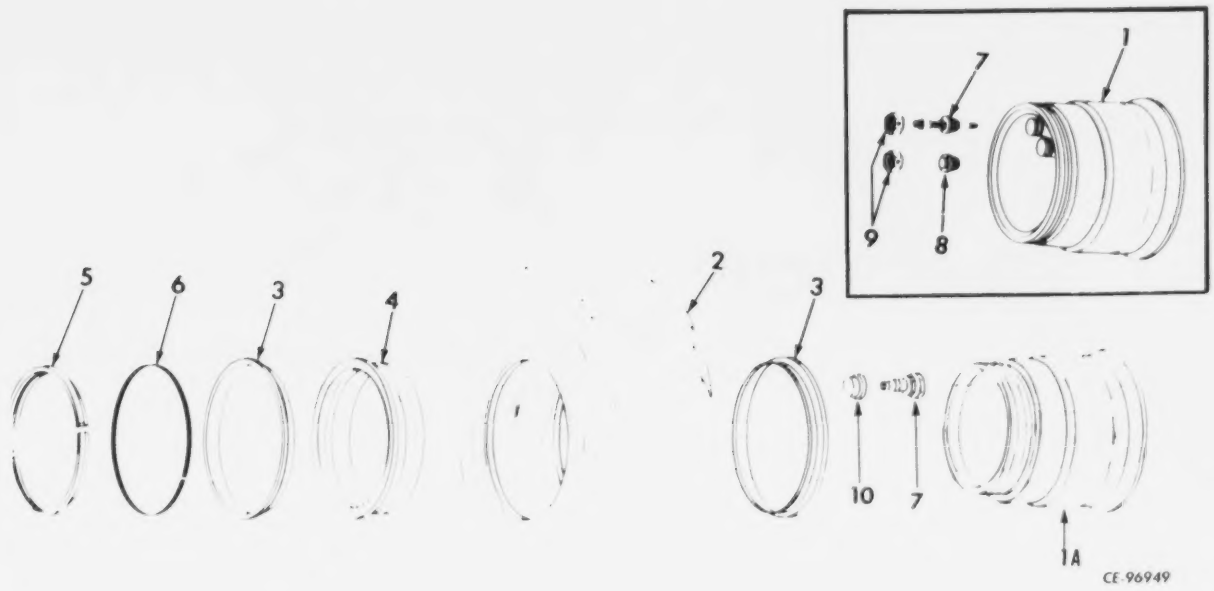
WHEEL AND MOUNTING




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | Parts without letters after the description indicates the part is used for all wheels listed below, Letters A thru D are used to identify separate wheels. |
| A | | Service Part for WHEEL, 201 699 H2 (With Double Inlet) (26.5 x 25 Tire Size) |
| B | | Service Part for WHEEL, 194 752 H1 (With Double Inlet) (29.5 x 25 Tire Size) |
| C | | Service Part for WHEEL, 892 456 C1 (With Single Inlet) (26.5 x 25 Tire Size) |
| D | | Service Part for WHEEL, 892 478 C1 (With Single Inlet) (29.5 x 25 Tire Size) |
| 1 | 201 699 H2 | WHEEL (Wheel A) U001121 and below C001002 and up |
| 1 | 194 752 H1 | WHEEL (Wheel B) U001121 and below C001002 and up |
| 1A | 892 456 C1 | WHEEL (Wheel C) U001122 and up |
| 1A | 892 478 C1 | WHEEL (Wheel D) U001122 and up |
| 2 | | TIRE (Purchase Locally) |
| 3 | 179 937 H1 | FLANGE (Wheel A and C) (2) |
| 3 | 172 647 H1 | FLANGE (Wheel B) (2) |
| 3 | 164 268 H1 | FLANGE (Wheel D) (2) |
| 4 | 141 254 H1 | BAND, bead seat (Wheel A, C and D) |
| 4 | 176 133 H1 | BAND, bead seat (Wheel B) |
| 5 | 141 255 H1 | RING, lock (Wheel A, C and D) |
| 5 | 176 134 H1 | RING, lock (Wheel B) |
| 6 | 141 253 H1 | "O" RING |
| 7 | 206 619 H2 | VALVE |
| 7 | 289 729 R91 | VALVE (Wheel C) |
| 8 | 206 620 H3 | VALVE, dummy (Wheel A and B) |
| 9 | 191 848 H1 | NUT (Wheel A and B) (2) |
| 10 | 289 729 R91 | CAP (Wheel C and D) |



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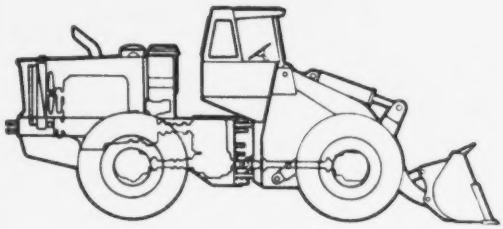
# SECTION 16

# BODY & BOWL



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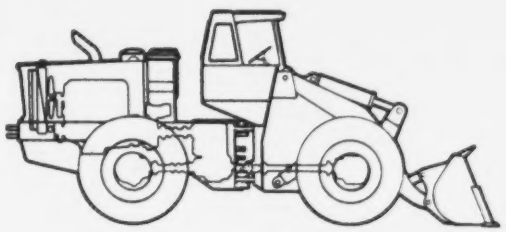
# SECTION 17

# MOUNTED EQUIPMENT



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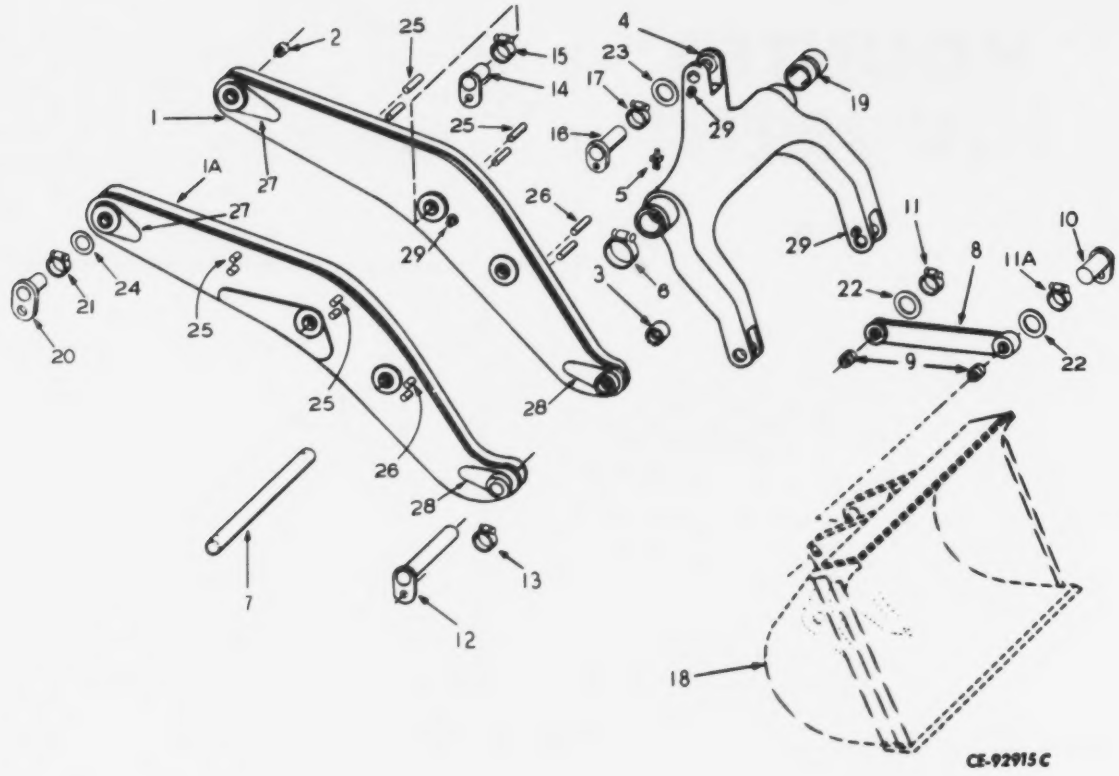
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

BOOM AND LINKAGE




| | | |
|---|---|---|
| 1 | 884 211 C2 | BOOM, w/two BUSHINGS 153 938 H1 and two BUSHINGS 198 933 H1, L.H. (Not used with Hydraulic Front End Attachment, 13' High Lift Boom Kit or Loader to Logger Kit) |
| 1 | 888 777 C1 | BOOM, w/two BUSHINGS 153 938 H1 and two BUSHINGS 198 933 H1, L.H. (Used on units equipped with Hydraulic Front End Attachment Kit and Loader to Logger Kit) |
| 1 | 890 526 C2 | BOOM, w/two BUSHINGS 153 938 H1 and two BUSHINGS 198 933 H1, L.H. (Used with 13' High Lift Boom Kit) |
| 1A | 884 212 C2 | BOOM, w/two BUSHINGS 153 938 H1 and two BUSHINGS 198 933 H1, R.H. (Not used with Hydraulic Front End Attachment, 13' High Lift Boom Kit or Loader to Logger Kit) |
| 1A | 888 778 H1 | BOOM, w/two BUSHINGS, 153 938 H1 and two BUSHINGS 198 933 H1, R.H. (Used on units equipped with Hydraulic Front End Attachment Kit or Loader to Logger Kit) |
| 1A | 890 527 C2 | BOOM w/two BUSHINGS 153 938 H1 and two BUSHINGS 198 933 H1, R.H. (Used with 13' High Lift Boom Kit) |
| 2 | 153 938 H1 | BUSHING (4) |
| 3 | 198 933 H1 | BUSHING (4) |
| 4 | 210 087 H5 | BELLCRANK, w/two BUSHINGS 177 033 H1 |
| 5 | 109 461 | FITTING, grease |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **BOOM AND LINKAGE - Continued** | | |
| 6 | 885 934 C1 | RING, cord (Together with two WASHER 22 256 R1, BOLT 19 797 R1 and NUT 20 090 R1 will work for Cord Ring (Solid) 191 417 H1) (2) |
| | 19 797 R1 | BOLT, 1/4NF x 4-1/4" (2) |
| | 22 256 R1 | WASHER, 1/4" (4) |
| | 20 090 R1 | NUT, 1/4NF elastic stop (2) |
| 7 | 196 498 H1 | SHAFT, pivot |
| | 273 090 | BOLT, 5/8NF x 7" (2) |
| | 18 453 R1 | NUT, 5/8" NF - 18 Esna (2) |
| 8 | 884 206 C91 | LINK, bucket w/two BUSHINGS 177 042 H1 (Not used with 13' High Lift Boom Kit) (2) |
| | 109 461 | FITTING, grease (4) |
| 8 | 891 853 C91 | LINK, bucket w/two BUSHINGS 177 042 H1 (Used with 13' High Lift Boom Kit) (2) |
| 9 | 177 042 H1 | BUSHING (4) |
| 10 | 179 678 H2 | PINLOCK, bucket link (4) |
| | 24 884 R1 | SCREW, 3/4" NC x 1" (Used w/WASHER, 932 279 C1) (4) |
| | 271 579 | SCREW, 5/8"NF x 1" (Used w/WASHER, 106 267 and WASHER, 103 325) (4) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) (4) |
| | 106 267 | WASHER, flat (Used w/SCREW, 24 884 R1) (4) |
| | 103 325 | WASHER, flat (Used w/SCREW, 271 579) (4) |
| 11 | 890 233 C1 | RING, cord (together with two WASHER, 22 256 R1, BOLT 186 301 and NUT 20 090 R1 will work for Cord Ring (Solid) 181 614 H1 (4) |
| | 22 256 R1 | WASHER, 1/4NF (8) |
| | 186 301 | BOLT, 1/4NF x 4" (4) |
| | 20 090 R1 | NUT, 1/4NF elastic stop (4) |
| 11A | 883 796 C1 | RING, cord (together with two WASHER 22 256 R1, BOLT 186 301 and NUT 20 090 R1 will work for Cord Ring (Solid) 181 614 H1) (4) |
| | 186 301 | BOLT, 1/4NF x 4" (4) |
| | 22 256 R1 | WASHER, 1/4NF (8) |
| | 20 090 R1 | NUT, 1/4NF elastic stop (4) |
| 12 | 884 203 C1 | PINLOCK, bucket pivot (2) |
| | 24 884 R1 | SCREW, 3/4" NC x 1" (Used w/WASHER, 932 279 C1) (2) |
| | 271 579 | SCREW, 5/8" NF x 1" (Used w/WASHER, 106 267 and WASHER, 103 325) (2) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) (2) |
| | 106 267 | WASHER, flat (Used w/SCREW, 271 579) (2) |
| | 103 325 | WASHER, lock (Used w/SCREW, 271 579) (2) |
| 13 | 883 796 C1 | RING, cord (Together with two WASHER 22 256 R1, BOLT 186 301 and NUT 20 090 R1 will work for Cord Ring (Solid) 181 614 H1) (4) |
| | 186 301 | BOLT, 1/4NF x 4" (4) |
| | 22 256 R1 | WASHER, 1/4NF (8) |
| | 20 090 R1 | NUT, 1/4NF elastic stop (4) |
| 14 | 202 295 H1 | PINLOCK, boom cylinder rod end (2) |
| | 24 884 R1 | SCREW, 3/4"NC x 1" (Used w/WASHER, 932 279 C1) (2) |
| | 271 579 | SCREW, 5/8" NF x 1" (Used w/ WASHER, 106 267 and WASHER, 103 325) (2) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) (2) |
| | 106 267 | WASHER, flat (Used w/SCREW, 271 579) (2) |
| | 103 325 | WASHER, lock (Used w/SCREW, 271 579) (2) |
| 15 | 885 934 C1 | RING, cord (Together with two WASHER 22 256 R1, BOLT 19 797 R1 and NUT 20 090 R1 will work for Cord Ring (Solid) 191 417 H1) (4) |
| | 19 797 R1 | BOLT, 1/4NF x 4-1/4" (4) |
| | 20 090 R1 | NUT, 1/4NF elastic stop (8) |
| | 22 256 R1 | WASHER, 1/4NF (4) |
| 16 | 199 154 H1 | PINLOCK, bucket cylinder rod end |
| | 24 884 R1 | SCREW, 3/4" NC x 1" (Used w/WASHER, 932 279 C1) |
| | 271 579 | SCREW, 5/8" NF x 1" (Used w/ WASHER, 106 267 and WASHER, 103 325) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) |
| | 106 267 | WASHER, flat (Used w/SCREW, 271 579) |
| | 103 325 | WASHER, lock (Used w/SCREW, 271 579) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **BOOM AND LINKAGE** - Continued | | |
| 17 | 885 934 C1 | RING, cord (together with two WASHER 22 256 R1, BOLT 19 797 R1 and NUT 20 090 R1 will work for Cord Ring (Solid) 191 417 H1) (2) |
| | 19 797 R1 | 1/4NF x 4-1/4" BOLT (2) |
| | 20 090 R1 | 1/4NF elastic stop NUT (4) |
| | 22 256 R1 | 1/4NF WASHER (2) |
| 18 | | BUCKET (See Bucket in this Section) |
| 19 | 177 033 H1 | BUSHING, bellcrank (2) |
| 20 | 195 700 H1 | PINLOCK, boom pivot (2) |
| | 24 884 R1 | SCREW, 3/4"NC x 1" (Used w/WASHER, 932 279 C91) (2) |
| | 271 579 | SCREW, 5/8" NF x 1" (Used w/WASHER, 106 267 and WASHER, 103 325) (2) |
| | 932 279 C1 | WASHER, flat (Used w/SCREW, 24 884 R1) (2) |
| | 106 267 | WASHER, flat (Used w/SCREW, 271 579) (2) |
| | 103 325 | WASHER, lock (Used w/SCREW, 271 579) (2) |
| 21 | 890 233 C1 | RING, cord (together with two WASHER, 22 256 R1, BOLT 186 301 and NUT, 20 090 R1 will work for Cord Ring (Solid) 169 724 H1) (4) |
| | 186 301 | BOLT, 1/4NF x 4" (4) |
| | 20 090 R1 | NUT, 1/4NF elastic stop (4) |
| | 22 256 R1 | WASHER, 1/4" (8) |
| 22 | 892 365 C1 | WASHER (8) |
| 23 | 890 349 C1 | WASHER (2) |
| 24 | 889 045 C1 | WASHER (4) |
| 25 | 183 649 H1 | STUDS (8) |
| 26 | 204 273 H1 | STUDS (4) |
| 27 | | SUPPORT (Not furnished separately) (Part of KIT, 895 708 C91) (4) |
| 28 | | SUPPORT (Not furnished separately) (Part of KIT, 895 708 C91) (4) |
| 29 | 932 051 C1 | BOSS, pinlock (5) |
| | 109 460 | FITTING (2) |
| | 890 627 C1 | WASHER (4) |
| | 895 708 C91 | KIT, boom reinforcing (Consists of four SUPPORT, four SUPPORT, BOOM REWORK INSTALLATION, FGH-12017 and BOOM REWORK-HI-LIFT INSTALLATION, FGH-12024) |



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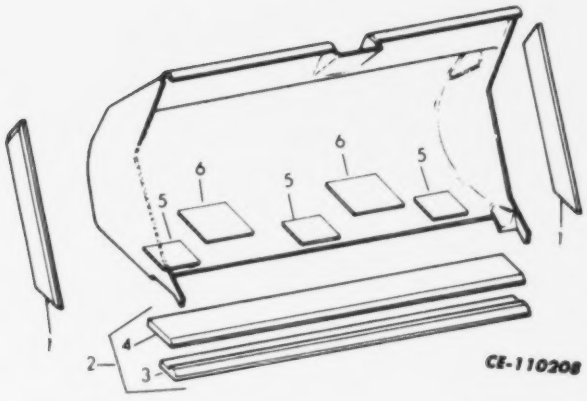
GENERAL PURPOSE BUCKET




Parts without letters after the description indicate the part is used for all Buckets listed below. Letters A, B, C and D are used to identify separate Buckets.

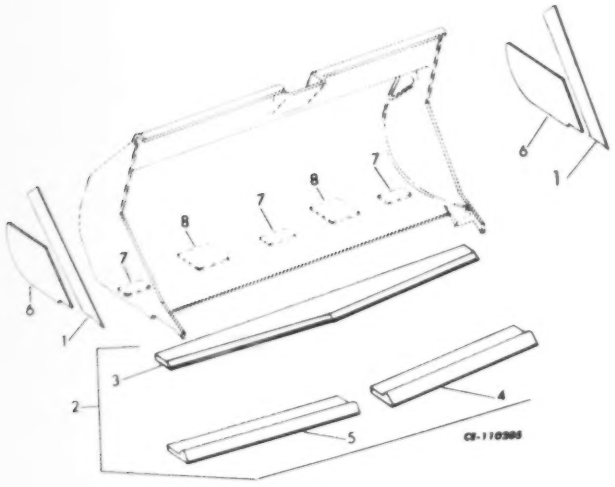
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 884 227 C92 | BUCKET (Order BUCKET, 932 058 C91) (4.25 cu.yd. 130-50 inch) (See NOTE 1) |
| B | 932 058 C92 | BUCKET (4.50 cu. yd. 130-50 inch) (See NOTE 1) |
| C | 889 310 C92 | BUCKET (Order BUCKET, 932 140 C91) (4.50 cu. yd. 130-50 inch) (See NOTE 1) |
| D | 932 140 C91 | BUCKET (5.00 cu. yd. 130-50 inch) (See NOTE 1) |
| E | 884 225 C92 | BUCKET (Order BUCKET, 932 150 C91) (5.00 cu. yd. 130-50 inch) (See NOTE 1) |
| F | 932 150 C91 | BUCKET (5.50 cu. yd. 130-50 inch) (See NOTE 1) |
| G | 893 176 C92 | BUCKET (4.25 cu. yd. 108 inch) (See NOTE 1) |
| 1 | 879 172 C1 | BLADE, side cutting (Bucket A, C, E and G) (2) |
| 1 | 938 048 C1 | BLADE, side cutting (Bucket B, D and F) (2) |
| 2 | 876 352 C1 | EDGE w/BACKING PLATE (Order EDGE, 924 063 C1)(Bucket A, C and E) (See NOTE 2) |
| 2 | 924 063 C1 | EDGE w/BACKING PLATE (Bucket A, B, C, D, E and F) |
| 2 | 877 967 C1 | EDGE w/BACKING PLATE (Order EDGE, 923 887 C1 (Bucket G) (See NOTE 2) |
| 2 | 923 887 C1 | EDGE w/BACKING PLATE (Bucket G) |
| 3 | 876 354 C1 | EDGE, 1-1/4" cutting (Order EDGE, 923 885 C1) (Bucket A, C and E) (See NOTE 2) |
| 3 | 923 885 C1 | EDGE, 2-1/4" cutting (Bucket A, B, C, D, E and F) |
| 3 | 216 955 H1 | EDGE, 1-1/4" cutting (Order EDGE, 923 888 C1) (Bucket G) (See NOTE 2) |
| 3 | 923 888 C1 | EDGE, 2-1/4" cutting (Bucket G) |
| 4 | | PLATE, backing (Not furnished separately) |
| 5 | | NOT USED |
| 6 | 938 115 C1 | BAR (14 inch) (Bucket B, D and F) (2) |

NOTE 1: On orders for Bucket, 884 227 C91, 889 310 C91, 884 225 C91 or 893 176 C91 equipped with teeth, furnish the comparable advanced bucket and the required number of corresponding new bucket teeth.

NOTE 2: On orders for Edge, 876 352 C1, 877 967 C1 or Cutting Edge, 876 354 C1 or 216 955 H1 when equipped with teeth furnish the comparable new Edge or Cutting Edge and the required number of corresponding new bucket teeth.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

SPADE NOSE BUCKET




Parts without letters after the description indicate the part is used for all Buckets listed below. Letters A and B are used to identify separate buckets.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | 889 373 C92 | BUCKET, spade nose rock (Order BUCKET, 932 215 C91)(4.25 cu. yd. 130-00 inch) (See NOTE 1) |
| B | 932 215 C92 | BUCKET, spade nose rock (4.50 cu. yd. 130-50 inch)(See NOTE 1) |
| 1 | 932 219 C2 | BLADE, side cutting (Bucket B)(2) |
| 2 | 889 369 C1 | EDGE w/BACKING PLATE (Order EDGE, 924 053 C1)(Bucket A) (See NOTE 2) |
| 2 | 924 053 C1 | EDGE w/BACKING PLATE |
| 3 | | PLATE, backing (Not furnished separately) |
| 4 | 890 360 C1 | EDGE, left hand cutting (1-1/4 inch) (Order EDGE, 923 983 C1) (Bucket A) (See NOTE 3) |
| 4 | 923 983 C1 | EDGE, left hand cutting (2-1/4 inch) |
| 5 | 890 361 C1 | EDGE, right hand cutting (1-1/4 inch) (Order EDGE, 923 984 C1) (Bucket A) (See NOTE 3) |
| 5 | 923 984 C1 | EDGE, right hand cutting (2-1/4 inch) |
| 6 | 932 220 C1 | PLATE, side (Bucket B) (2) |
| 7 | | NOT USED |
| 8 | 938 115 C91 | BAR, wear (14 inch) (Bucket B) (2) |

NOTE 1: On orders for Bucket, 889 373 C91 when equipped with teeth, furnish the comparable new bucket and the required number of the corresponding Bucket Teeth).

NOTE 2: On orders for Edge, 889 369 C1 when equipped with teeth, furnish comparable new Edge and the corresponding Bucket Teeth).

NOTE 3: On orders for left hand Edge, 890 360 C1 or Right Hand Edge, 890 361 C1 when bucket is equipped with teeth, furnish both left and right comparable new blade tips and the required number of the corresponding new Bucket Teeth.



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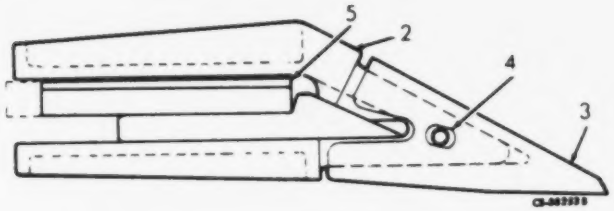
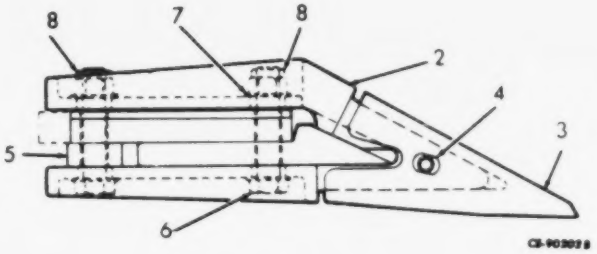
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**BUCKET TEETH (With Cutting Edge of 1-1/4" Thickness) (Welded)**




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 2 | 206 957 H3 | SHANK |
| 3 | 181 266 H2 | TIP, replaceable |
| 4 | 160 163 H1 | PIN, roll |
| 5 | 215 416 H1 | SPACER |
| | 215 417 H1 | SHIM |

**BUCKET TEETH (With Cutting Edge of 1-1/4" Thickness) (Bolted)**




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 2 | 206 957 H3 | SHANK |
| 3 | 181 266 H2 | TIP, replaceable |
| 4 | 160 163 H1 | PIN, roll |
| 5 | 103 075 H1 | SLEEVE |
| 6 | 271 665 | BOLT, 7/8 x 4-1/4NC (2) |
| 7 | 103 347 | WASHER, flat · 7/8 (2) |
| 8 | 18 549 R1 | NUT, 7/8 x 9NC (2) |

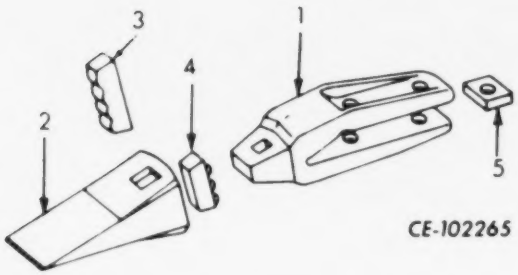
**BUCKET TEETH (With Cutting Edge of 1-1/4" Thickness)**

Parts without letters after the description indicates the part is used for all Tooth Assemblies. Letters "A" and "B" are used to identify separate Tooth Assemblies.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| A | | Service parts for BOLT ON TOOTH ASSEMBLY |
| B | | Service parts for WELD ON TOOTH ASSEMBLY |
| 1 | 886 355 C2 | ADAPTER |
| 2 | 928 459 C1 | PIN, slotted spring (2) |
| 3 | 886 351 C1 | POINT |
| 4 | 103 347 | WASHER, 7/8" flat (Tooth A) (4) |
| 5 | 271 665 | BOLT, 7/8NC x 4-1/4" (Tooth A) (2) |
| 6 | 103 075 H1 | SPACER (Tooth A) |
| 7 | 18 549 R1 | NUT, 7/8" 9 NC (Tooth A) (2) |
| 8 | 215 416 H1 | SPACER (Tooth B) |
| | FGH 10853 | DRAWING, installation (Tooth A) |
| | 215 412 H1 | DRAWING, installation (Tooth B) |
| | 215 417 H1 | SHIM (Tooth B) |
| | 205 315 H1 | SHIM (Tooth A) |

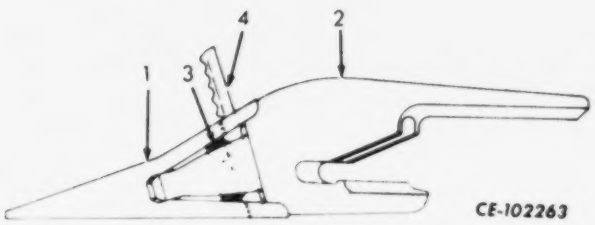
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

GENERAL PURPOSE BUCKET TEETH (With Cutting Edge of 2-1/4" Thickness)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 925 476 C1 | SHANK, tooth |
| | 22 338 R1 | BOLT, 7/8 x 5" (For bolted tooth) (2) |
| | 452 165 R1 | NUT, 7/8 nylon (For bolted tooth) (2) |
| 2 | 883 267 C1 | TIP, tooth |
| 3 | 883 268 C1 | PIN |
| 4 | 883 269 C1 | PINLOCK |
| 5 | 925 477 C1 | SPACER (for welded tooth) |
| 5 | 925 478 C1 | SPACER (for bolted tooth) |

SPADE NOSE BUCKET TEETH (With Blade Tip of 2-1/4" Thickness)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 925 472 C1 | TIP, tooth |
| 2 | 925 470 C1 | SHANK, L.H. tooth |
| 2 | 925 471 C1 | SHANK, R.H. tooth |
| 3 | 925 474 C1 | PINLOCK |
| 4 | 925 473 C1 | PIN |



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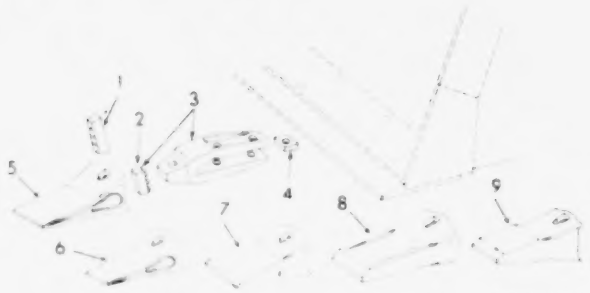
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**BUCKET TEETH AND TOOTH TIPS**
**(Standard and Optional Teeth with Top and Full Bottom Mount Tooth Shank) (For General Purpose Bucket with Cutting Edge of 2-1/4" Thickness)**




CE-104497

| | | |
|---|---|---|
| 1 | 883 268 C1 | PIN |
| 2 | 883 269 C1 | LOCK, pin |
| 3 | 925 476 C1 | SHANK, top and full bottom mount |
| | 22 338 R1 | BOLT, 7/8NC x 5" (2) |
| | 452 165 R1 | NUT, 7/8" nylon insert (2) |
| 4 | 925 478 C1 | SPACER (Hole in center) |
| 4 | 925 477 C1 | SPACER (Solid surface) |
| 5 | 883 267 C1 | TIP, T-shape |
| 6 | | NOT USED |
| 7 | 929 512 C1 | TIP, sharp flared |
| 8 | 637 618 C1 | TIP, long panel (Replaces 929 513 C1) |
| 9 | | NOT USED |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**BUCKET TEETH AND TOOTH TIPS**
**(Standard and Optional Teeth with Top and Half Bottom Mount Tooth Shank) (For Straight Edge Rock Bucket and Spade Nose Bucket with Cutting Edge of 2-1/4" Thickness)**

CE-104495

| | | |
|---|---|---|
| 1 | 925 473 C1 | PIN |
| 2 | 925 474 C1 | LOCK, pin |
| 3 | 925 470 C1 | SHANK, top and half bottom mount, L.H. |
| 3 | 925 471 C1 | SHANK, top and half bottom mount R.H. |
| 4 | 925 472 C1 | TIP, T-shape |
| 5 | | NOT USED |
| 6 | 1 122 145 C1 | TIP, sharp flared (Replaces 929 515 C1) |
| 7 | 929 514 C1 | TIP, long panel |
| 8 | | NOT USED |

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(965)

## TO THE OWNER

IT IS THE POLICY OF INTERNATIONAL HARVESTER COMPANY TO IMPROVE ITS PRODUCTS WHENEVER IT IS POSSIBLE AND PRACTICAL TO DO SO. WE RESERVE THE RIGHT TO MAKE CHANGES OF ADD IMPROVEMENTS AT ANY TIME WITHOUT INCURRING ANY OBLIGATION TO INSTALL SUCH CHANGES ON PRODUCTS PREVIOUSLY SOLD.

When ordering parts, always give the following information:

1. The IH part number, including suffix or prefix letters, the name of the part and the quantity needed. Do not include the illustration reference number.

2. The complete engine serial number of the machine, including the serial sequence number. (Refer to "SERIAL NUMBERS" in INTRODUCTION.)

We suggest that you write the serial numbers for your machine in the space provided below, for ready reference when parts are needed.

ENGINE _____

(Stamped on a pad on L.H. side of crankcase near the center and just below the turbocharger)



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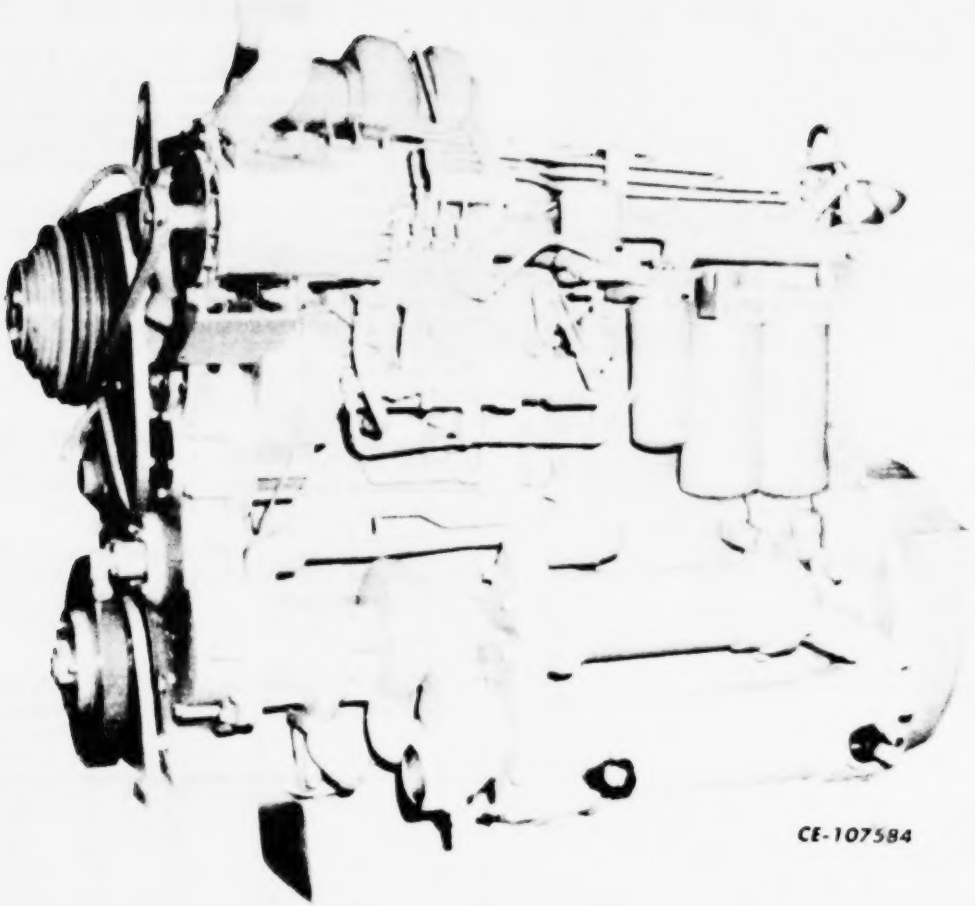


Left Side View of the 817 SERIES C Diesel Engine.
(View Shown of Engine is for the 560 PAYloader
Equipped with Fuel Reservoir and Scavenging Oil Pump)

This catalog contains a list of service parts for the DT and DTI-817C engines used in the following applications:

| ENGINE | APPLICATION |
|---|---|
| DT-817C | H-100C and D-120C |
| DTI-817C | TD-25C, 330, 340 & 560 |

The DT-817C is a six-cylinder 5-3/8 x 6" turbocharged diesel engine. The DTI-817C is a six-cylinder 5-3/8 x 6" turbocharged-intercooled diesel engine.

This catalog is divided into major sections which, in turn, are sub-divided into units. A listing of the major sections is shown on the flyleaf prefacing this publication. The tabs on the right-hand side of the first page of each of these indexes correspond to the tabs shown on the flyleaf. A numerical index at the back of the catalog contains a listing of part numbers showing the section and page number where each part is listed and described.

Illustrations, in the form of exploded views, are provided to aid in locating and identifying parts. Parts illustrated are of typical parts and not necessarily detailed drawings. Reference numbers in the illustration tie in each simple part, assembly or group of parts with a list of parts following each illustration. Parts are listed in reference number order as shown in the illustration, followed by the noun name of the part with the modifying descriptive information which serves to specifically identify the item. Parts not shown in the illustrations appear at the end of the unit list affected. Parts listed are for all applications. When parts are not common to all applications, the reference number will be followed by the phrase "(See individual engine variation)." Locate your specific application under heading "ENGINE VARIATIONS" located at end of unit parts list.

**ASSEMBLIES.** Wherever possible, the component parts of assemblies are shown in the "exploded views" by use of boxes, brackets or arrows. When assemblies cannot be shown as mentioned, they will be listed by one of the following methods:

(a) The listings are fully covered by descriptions for simple assemblies.

(b) When four or more parts are contained in the assemblies, the listing of components immediately follows the description with the wording "(Composed of-)."

(c) Assemblies consisting of many parts show the assembly number at the beginning of the unit list, followed by the listing of the components.

The quantity of each item is shown following the description of the item. Where no quantity is shown, this indicates that only "-1-" is required.

Individual parts of an assembly not available for service are shown with the symbol §. In these cases, the complete assembly must be ordered for service.

In many parts list, it is possible to include more than one assembly. The assemblies are listed at the beginning of the parts lists with the letters "A", "B", "C", etc., preceding the part number of the assembly. The number required information is shown in parenthesis following the description of the parts. When letters ("A", "B", "C", etc.) are shown without a quantity, it should be understood to mean only (1) is required. Parts without letters after the description indicate the part is used for all assemblies listed in the heading.

Exceptions to the above methods are explained by footnotes in the text.

## MISCELLANEOUS PARTS

Standard bolts, screws, nuts, etc. – are not identified by a reference number. These parts are known as COMMON HARDWARE items and appear in abbreviated nomenclature and are shown indented under the major items with which they are used. They should be ordered as listed, since they are not component parts of the pieces they attach.

Hardware sizes will only be shown when more than one size is used to mount a part. Only one dimension will be shown to differentiate hardware.

WARNING: Attaching parts especially made for their location should never be substituted with regular standard parts.

The following rules are established to govern the listing of attaching parts:

All Carriage, Machine and Plow BOLTS; NUTS, Cap, Machine and Set SCREWS, will be considered furnished with National Coarse Thread unless otherwise specified. The number of threads per inch will be eliminated.

Standard bolts used in International Harvester Products are manufactured under standards known as Unified National Coarse Thread (U.N.C.) and Unified National Fine Thread (U.N.F.) with the number of threads per inch for various diameters as follows:

| Diameter of Bolts | No. of Threads per inch (U.N.C.) | No. of Threads per inch (U.N.F.) |
|---|---|---|
| 1/4" | 20 | 28 |
| 5/16" | 18 | 24 |
| 3/8" | 16 | 24 |
| 7/16" | 14 | 20 |
| 1/2" | 13 | 20 |
| 9/16" | 12 | 18 |
| 5/8" | 11 | 18 |
| 3/4" | 10 | 16 |
| 7/8" | 9 | 14 |
| 1" | 8 | 14 |
| 1-1/8" | 7 | 12 |
| 1-1/4" | 7 | 12 |
| 1-3/8" | 6 | 12 |
| 1-1/2" | 6 | 12 |

All NUTS will be considered "hex" unless otherwise specified.



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**MISCELLANEOUS PARTS – Continued**

All WASHERS will be considered "Plain" unless otherwise specified. The "ID", "OD" and "No." identity will be eliminated. The inside dimension will be listed first, followed by the outside diameter and the thickness.

All lock WASHERS will be considered "Medium" type unless specified as "Light" or "Heavy."

All cotter PINS will be considered "Extended-Prong" type unless otherwise specified.

All groove PINS will be considered "Standard Groove' unless otherwise specified.

All common RIVETS will be considered "Annealed" unless otherwise specified.

All countersunk-head tubular RIVETS will be considered "Copper-Plated Steel" unless otherwise specified.

All oval-head tubular RIVETS will be considered "Brass."

WHEN ORDERING PARTS, ALWAYS USE INTERNATIONAL HARVESTER PART NUMBERS AND DESCRIPTIONS SHOWN IN THE PARTS LIST.

SERIAL NUMBERS

| ENGINE APPLICATION | ENGINE MODEL CODE (KIND) | VARIATION CODE | COUNTRY OF ORIGIN | SERIAL SEQUENCE NO. |
|---|---|---|---|---|
| TD-25 SERIES C PAYdozer | 818B | C2 | U (U.S.A.) | 010001 |
| H-100C PAYloader and D-120C PAYloader | 818T | H2 | U (U.S.A.) | 010001 |
| 330 and 340 PAYhaulers | 818B | P2 | U (U.S.A.) | 010001 |
| 560 PAYloader | 818B | H2 | U (U.S.A.) | 010001 |

The engine serial numbers are stamped on a pad on the L.H. side of crankcase near the center and just below the turbocharger.

Only the sequence number of the complete engine serial number is listed in this catalog to identify parts.

Customers are to be urged to supply the complete engine serial number when ordering parts. No attempt is made at the factory to have the engine and chassis serial numbers correspond.

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(%) – Not furnished with replacement service engine. Refer to Chassis Catalog.

(+) – Not furnished with replacement service engine for TD-25C Crawler Tractor, 330 and 340 PAYhaulers, and H-560 PAYloader, refer to Chassis Catalog.



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REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS



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**REPLACEMENT SERVICE ENGINES**
**(Ready to Run)**
**(See NOTE A)**

| ENGINE | MACHINE | ENGINE PART NO. |
|---|---|---|
| DT-817C | D-120C PAYdozer<br>H-100C PAYloader (320 HP) | 684 466 C92 (%) |
| DTI-817C | TD-25 SERIES C PAYdozer (Manual Shift) (338 HP) (Will work for ENGINE, 684 464 C91, 320 HP) | 678 463 C92 (%) |
| | TD-25 SERIES C PAYdozer (Power Shift) (338 HP) (Will work for ENGINE, 684 465 C91 and Arctic ENGINE, 678 481 C91, 320 HP) | 684 473 C92 (%) |
| | TD-25 SERIES C PAYdozer (Arctic) | 678 481 C91 (%)(+) |
| | 330 PAYhauler (420 HP) | 684 468 C92 (%) |
| | 340 PAYhauler (420 HP) | 684 468 C92 (%) |
| | 560 PAYloader (420 HP) | 684 470 C92 (%) |

NOTE A – When ordering a service engine, give complete serial number (including letters and numerals) shown on crankcase of engine to be replaced.

(%) – Includes all current parts listed throughout this catalog for this particular engine variation except as noted. Optional parts, packages and (x) - as required parts listed in Section 2 thru 17 are not included.

(+) – Order ENGINE, 684 473 C92.



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## SKELETON ENGINE (DT, DTI-817 SERIES C)

FOR

TD-25 SERIES C PAYdozer, H-100C PAYloaders,
D-120C PAYdozer, 330 and 340 PAYhauler
560 PAYloader

684 462 C92 SKELETON ENGINE 817 SERIES C (See NOTE)
(Consists of -

Camshaft and Related Parts
Connecting Rods, Pistons, Rings and Cylinder Sleeves
Crankcase, Front Plate, Fan, Idler Gear and Related Parts
Crankshaft, Bearings and Related Parts
Injection Pump Drive and Gear
Oil and Water Pump

NOTE: When ordering a Skeleton Engine, give serial number (including letters and numerals) shown on crankcase of engine to be replaced.

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

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## QUICK REFERENCE
## FOR
## FILTER ELEMENTS AND BELTS

| MACHINE | ENGINE | PRIMARY FUEL FILTER | FINAL FUEL FILTER | LUBRICATING OIL FILTER | FAN AND/OR ALTERNATOR BELT | AIR COMPRESSOR BELT |
|---|---|---|---|---|---|---|
| H-100C | DT-817C | 625 627 C1 | 674 293 C1 | (@) | 670 939 C2 (13744 & Below)<br>685 509 C1 (13745 & Up) | 601 684 C1 |
| TD-25C | DTI-817C | (%) | 674 293 C1 | (@) | 670 582 C1 (12007 & Below)<br>326 998 R1 (12008 & Up) | - - - - - - - - - - - - |
| 330 | DTI-817C | (%) | 674 293 C1 | (@) | 670 464 C1 (14513 & Below)<br>685 509 C1 (14514 & Up) | - - - - - - - - - - - - |
| 340 | DTI-817C | (%) | 674 293 C1 | (@) | 670 464 C1 (14513 & Below)<br>685 509 C1 (14514 & Up) | - - - - - - - - - - - - |
| 560 | DTI-817C | (%) | 674 293 C1 | (@) | 670 464 C1 | 672 445 C1 |

(%) – Refer to Chassis Catalog.

(@) – Refer to Section 13.



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# MISCELLANEOUS

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

## PACKAGES AND KITS

NOTE: For detail list of parts, refer to page indicated.


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**SECTION 4 – CONNECTING ROD AND PISTON**

687 005 C91 PACKAGE, piston ring field service ..... 4-3

684 460 C91 PACKAGE, piston, sleeve and ring service. ..... 4-3

684 461 C91 PACKAGE, cylinder sleeve packing ring service ..... 4-3

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**SECTION 6 – CRANKCASE**

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332 662 R94 PACKAGE, crankcase gasket. ..... 6-4

**SECTION 8 – CYLINDER HEAD**

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678 536 C91 PACKAGE, crankshaft rear oil seal (330, 340, TD-25C) ..... 10-3, 10-5

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# CAMSHAFT 3

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

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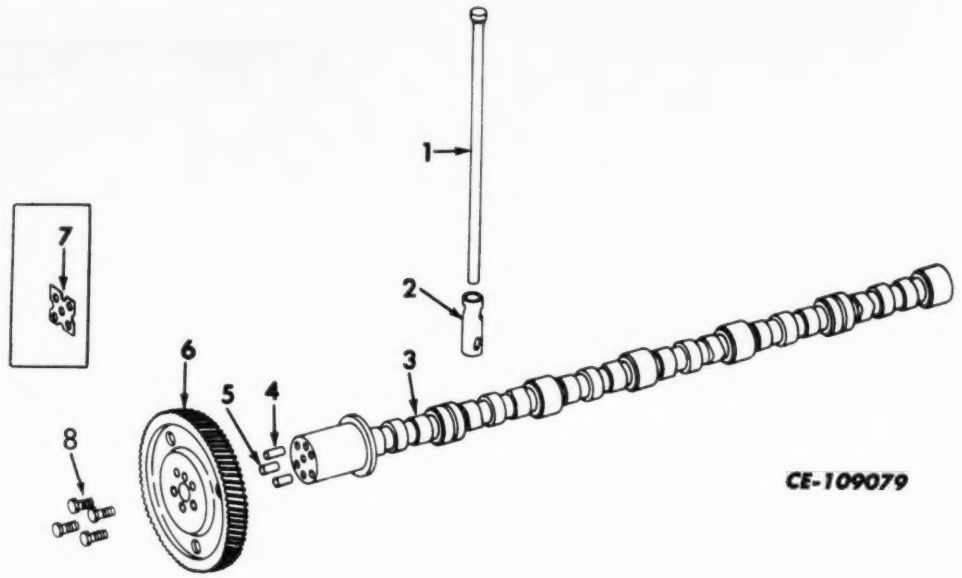
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

CAMSHAFT AND RELATED PARTS




| | | | | | |
|---|---|---|---|---|---|
| 1 | 678 053 C1 | ROD, push (12) | 7 | 277 124 R1 | LOCKPLATE, camshaft gear (Order four SCREW, 25 810 R1 and four WASHER, 685 902 C1) |
| 2 | 682 944 C1 | TAPPET, valve (12) | | 21 177 R1 | SCREW, hex hd. cap (4) |
| 3 | 670 187 C11 | CAMSHAFT w/PLUG, 277 120 R1 and two PIN, 684 731 C1 | 8 | 25 810 R1 | SCREW, hex-hd cap (Together w/ four WASHER, 685 902 C1, will work for LOCKPLATE, 277 124 R1)(4) |
| 4 | 684 731 C1 | PIN, 1/2 x 1" dowel (Replaces 141 283) (2) | | 685 902 C1 | WASHER, hardened (4) |
| 5 | 277 120 R1 | PLUG, tachometer drive | | | |
| 6 | 349 400 R2 | GEAR, camshaft (80-T) | | | |



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# CONNECTING ROD AND PISTON 4

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

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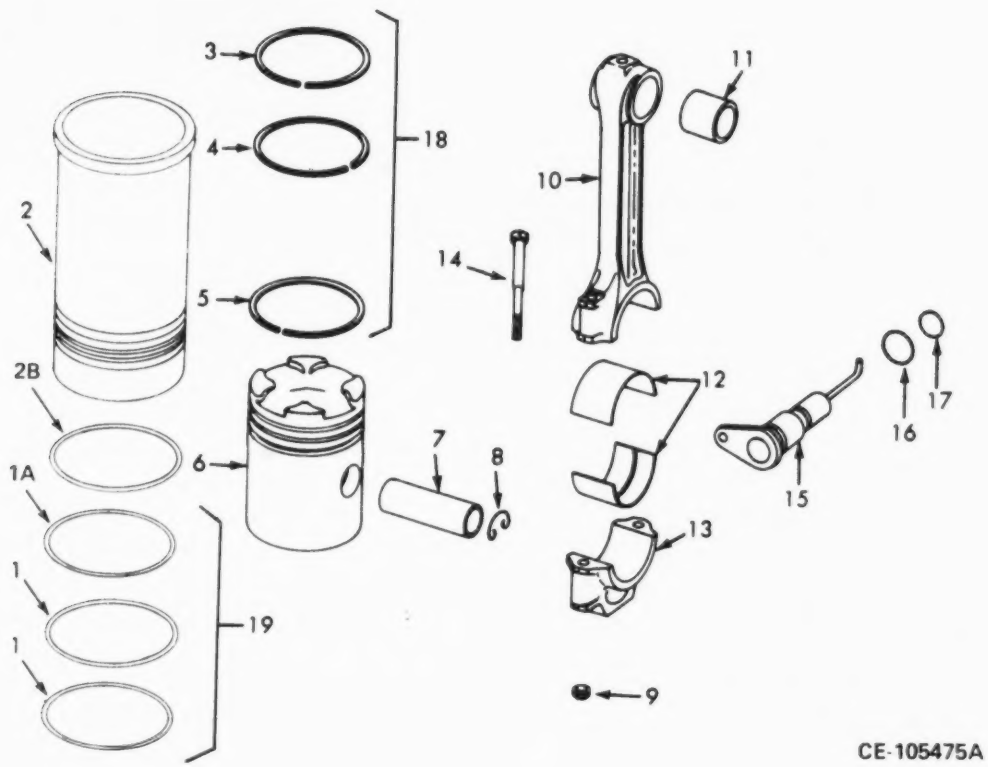
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

CONNECTING RODS, PISTONS AND CYLINDER SLEEVES




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | RING, cylinder sleeve packing (Not Furnished Separately) (12) |
| 1A | | RING, cylinder sleeve packing (Not Furnished Separately) (6) |
| 2 | 674 283 C1 | SLEEVE, cylinder (6) |
| 2B | | SHIM, (Order PACKAGE, 684 926 C91) (6) |
| 3 | | RING, top compression piston (Not Furnished Separately) (6) |
| 4 | | RING, intermediate compression piston (Not Furnished Separately) (6) |
| 5 | | RING, oil regulating piston (Not Furnished Separately) (6) |
| 6 | | PISTON (Order PACKAGE, 684 460 C91) (6) |
| 7 | 671 228 C1 | PIN, piston (6) |
| 8 | 349 439 R1 | RING, piston pin retainer (12) |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CONNECTING RODS, PISTONS AND CYLINDER SLEEVES - Continued** |
| 9 | 625 339 C1 | NUT, connecting rod bolt (12) |
| 10 | 671 279 C91 | ROD w/two BOLT, 305 916 R2, two NUT, 625 339 C1, BUSHING, 670 831 C1, and CAP, connecting (6) |
| 11 | 670 831 C1 | BUSHING, connecting rod (6) |
| 12 | 277 144 R91 | BEARING, connecting rod (Standard) (6) |
| 12 | 320 043 R11 | BEARING, connecting rod (.010" undersize) (6) |
| 12 | 253 750 R91 | BEARING, connecting rod (.030" undersize) (6) |
| 13 | | CAP, connecting rod (Order ROD, 671 279 C91) |
| 14 | 305 916 R2 | BOLT, connecting rod (12) |
| 15 | 303 469 R94 | JET, piston coolant (6) |
| | 25 496 R1 | SCREW, hex-hd cap (5) |
| | 140 483 H | SCREW, hex-hd cap |
| | 50 793 H | SPACER |
| | 25 896 R1 | WASHER, hardened (6) |
| 16 | 343 396 R2 | "O" RING, piston coolant jet (1-1/8" ID) (Large) (Replaces, 356 005 R1) (6) |
| 17 | 687 010 C1 | "O" RING, piston coolant jet (7/8" ID) (Replaces 253 070 R1) (Small) (6) |
| 18 | 687 005 C91 | PACKAGE, piston ring field service (x) |
| 19 | 684 461 C91 | PACKAGE, cylinder sleeve packing ring (x) |
| | 684 460 C91 | PACKAGE, piston, sleeve and ring service (Consists of - 1 PACKAGE 684 461 C91; § 1 PISTON; 2 RING 349 439 R1; § 3 RING; 1 SLEEVE 674 283 C1; § 1 SHIM; § 1 SHIM ) |
| | 684 926 C91 | PACKAGE, cylinder sleeve shim (Consists of eight SHIMS)(x) |

§ – Not Furnished Separately
(x) – As Required

# COOLING 5

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

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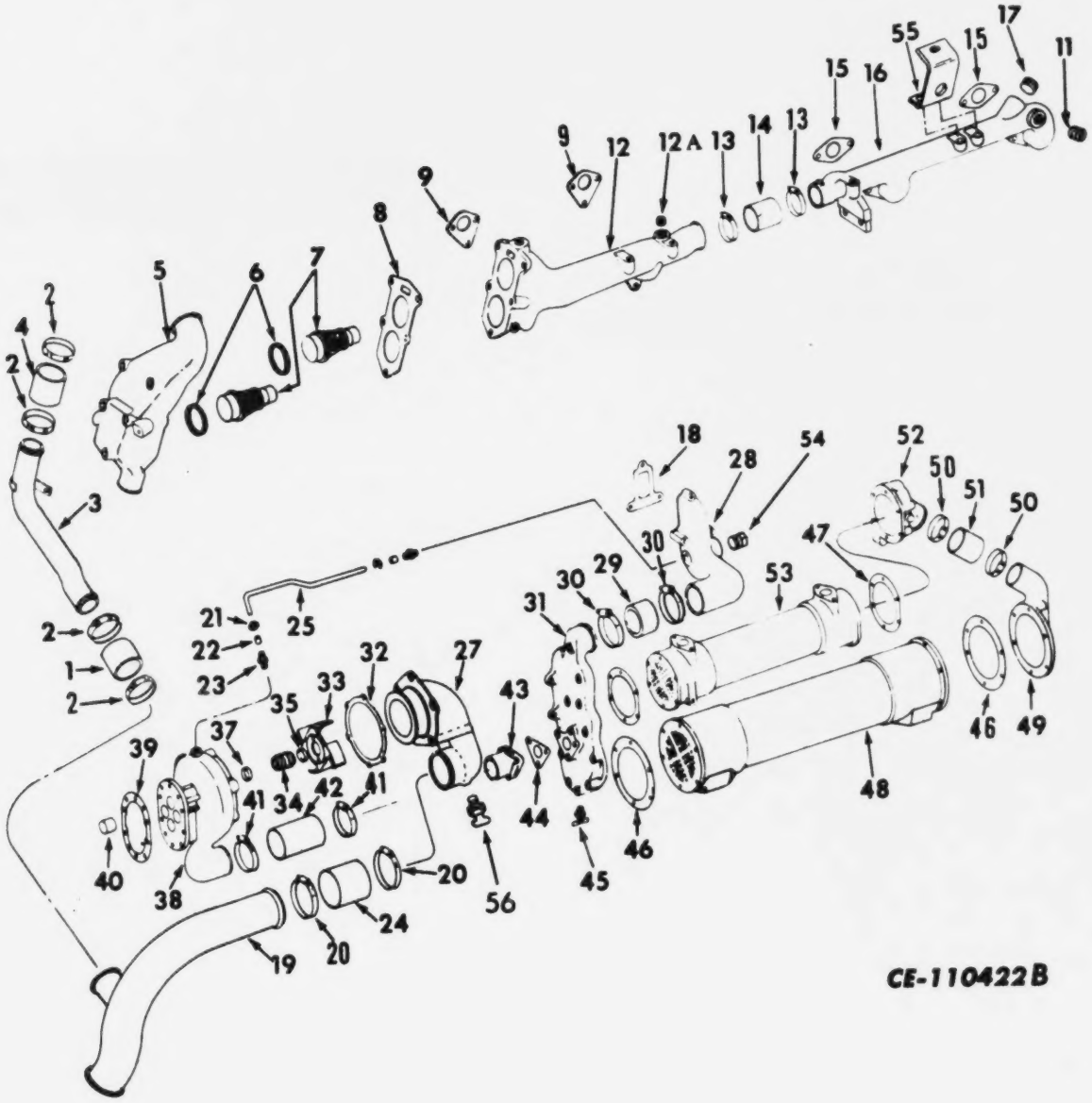
WATER PUMP, OIL COOLER, WATER MANIFOLD,
THERMOSTATS AND RELATED PARTS
(TD-25 C (Power Shift and Arctic), 330 and 340)



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**WATER PUMP, OIL COOLER, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS – Continued (TD-25 C (Power Shift and Arctic), 330 and 340)**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | (See Individual Engine Variation) |
| 2 | 401 345 R1 | CLAMP, thermostat by-pass pipe hose (4) |
| 3 | | (See Individual Engine Variation) |
| 4 | 346 756 R1 | HOSE, thermostat by-pass pipe upper |
| 5 | | (See Individual Engine Variation) |
| 6 | 310 947 R91 | SEAL, thermostat (2) |
| 7 | 324 391 R91 | THERMOSTAT (180° - 195°) (2) |
| | or | |
| 7 | 625 095 C1 | THERMOSTAT (180° - 202°) (2) |
| 8 | 316 112 R2 | GASKET, thermostat housing |
| 9 | 303 782 R1 | GASKET, front water manifold (2) |
| 11 | 445 751 | PLUG, auto sq-soc pipe |
| 12 | 320 104 R2 | MANIFOLD, water front |
| | 24 847 R1 | SCREW, hex-hd cap |
| | 140 483 H | SCREW, hex-hd cap (5) |
| | 25 896 R1 | WASHER, hardened (6) |
| | 445 751 | PLUG, sq-soc hd |
| 12A | 444 588 | PLUG, 1/2" sq-hd pipe |
| 13 | 397 256 R1 | CLAMP, water manifold hose (2) |
| 14 | 346 758 R1 | HOSE, water manifold (2-1/4 x 2-5/8 x 2-1/2" long) |
| 15 | 279 384 R2 | GASKET, water manifold rear (2) |
| 16 | 701 167 C92 | MANIFOLD w/PLUG, 444 678 and PLUG, 445 751, rear water |
| | 24 840 R1 | SCREW, hex-hd cap (4) |
| | 25 896 R1 | WASHER, hardened (4) |
| 17 | 444 678 | PLUG, 1" sq-soc pipe |
| 18 | 278 794 R1 | GASKET, engine water inlet elbow |
| 19 | | (See Individual Engine Variation) |
| 20 | 27 314 R1 | CLAMP, radiator to water pump pipe hose (2) |
| 21 | 277 742 R1 | NUT, water pump air bleed (2) |
| 22 | 277 741 R2 | SLEEVE, water pump air bleed (2) |
| 23 | 278 098 R1 | CONNECTOR, water pump air bleed (1/4 x 3/8") (2) |
| 24 | | (See Individual Engine Variation) |
| 25 | 278 987 R2 | PIPE, water pump air bleed |
| 27 | 318 171 R11 | ELBOW w/PLUG, 20 972 R1, water pump inlet |
| | 24 840 R1 | SCREW, hex-hd cap (4) |
| | 277 232 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (5) |
| 28 | 318 123 R2 | ELBOW, engine water inlet |
| | 24 621 R1 | SCREW, hex-hd cap (2) |
| | 24 842 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (3) |
| 29 | 346 755 R1 | HOSE, engine water inlet elbow (2-1/4 x 2-5/8 x 3-1/4" long) |
| 30 | 401 345 R1 | CLAMP, engine water inlet elbow hose (2) |
| 31 | 318 124 R1 | HEADER, engine and torque converter oil cooler water front inlet |
| | 24 864 R1 | SCREW, hex-hd cap (2) |
| | 26 273 R1 | WASHER, hardened (2) |
| 32 | 277 491 R1 | GASKET, water pump inlet elbow |
| 33 | 310 095 R1 | IMPELLER, water pump |
| 34 | | SEAL, water pump coolant (Order PACKAGE, 687 366 C91) |
| 35 | | SEAT, water pump seal (Order PACKAGE, 687 366 C91) |
| 37 | 317 847 R91 | SEAL, water pump oil |
| 38 | 674 243 C91 | HOUSING w/two PLUG, 444 687 and BUSHING, 303 939 R1, water pump |
| | 179 840 | SCREW, hex-hd cap (8) |
| | 103 321 | WASHER, lock (8) |
| 39 | 277 525 R2 | GASKET, water pump housing |
| 40 | 303 939 R1 | BUSHING, water pump body |
| 41 | 401 345 R1 | CLAMP, water pump outlet hose (2) |
| 42 | 346 754 R1 | HOSE, water pump outlet (2-1/4 x 2-5/8 x 2-1/4" long) |
| 43 | 308 470 R1 | CONNECTOR, header water inlet |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 24 846 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (3) |
| 44 | 308 471 R1 | GASKET, header water inlet connector |
| 45 | 31 729 D | VALVE, 3/8" type "C" drain |
| 46 | 330 251 R1 | GASKET, torque converter cooler (2) |
| 47 | 278 985 R1 | GASKET, engine oil cooler (2) |
| 48 | | (See Individual Engine Variation) |

**WATER PUMP, OIL COOLERS, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS - Continued (TD-25C (Power Shift and Arctic), 330 and 340)**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 49 | 340 703 R1 | HEADER, torque converter cooler rear outlet |
| | 25 689 R1 | BOLT, 7-1/2" long hex-hd cap |
| | 444 654 | PLUG, sq-soc-hd pipe (2) |
| | 25 296 R1 | SCREW, 6-1/2" long hex-hd cap |
| | 26 273 R1 | WASHER, lock (2) |
| 50 | 397 256 R1 | CLAMP, engine oil cooler water outlet hose (2) |
| 51 | 346 759 R1 | HOSE, engine oil cooler water outlet (2-1/2 x 2-7/8 x 4") |
| 52 | 310 107 R1 | HEADER, engine oil cooler water rear |
| | 24 864 R1 | SCREW, 2" long hex-hd cap |
| | 25 296 R1 | SCREW, 6-1/2" long hex-hd cap |
| | 26 273 R1 | WASHER, hardened (2) |
| 53 | 310 097 R91 | COOLER, lubricating oil |
| | 140 483 H | SCREW, 1-1/4" long hex-hd cap |
| | 24 842 R1 | SCREW, 1-3/4" long hex-hd cap (5) |
| | 275 804 R1 | SCREW, 3" long hex-hd cap (5) |
| | 24 845 R1 | SCREW, 4" long hex-hd cap |
| | 25 896 R1 | WASHER, hardened (12) |
| 54 9 | 409 949 | PLUG, 3/4" NPT pipe sq-soc |
| 55 | | (See Individual Engine Variation) |
| 56 | | (See Individual Engine Variation) |
| | 701 168 C94 | PUMP ASSEMBLY, water and lubricating oil (Composed of |
| | | 1 BODY 670 192 C11 |
| | | 1 BODY 277 440 R11 |
| | | 1 FLINGER 345 049 R1 |
| | | 2 GASKET 277 525 R2 |
| | | 1 GEAR 607 122 C11 |
| | | 1 GEAR 670 190 C1 |
| | | 1 GEAR 607 121 C1 |
| | | 1 GEAR 607 220 C11 |
| | | 1 HOUSING 674 243 C91 |
| | | 1 IMPELLER 310 095 R1 |
| | | 1 KEY 124 546 |
| | | 1 NUT 625 342 C1 |
| | | 1 PAMPHLET 1 014 780 R1 |
| | | 1 PACKAGE 687 366 C91 |
| | | 1 SEAT 684 432 C1 |
| | | 1 SEAL 317 847 R91 |
| | | 1 SHAFT 701 169 C91 ) |
| | 24 841 R1 | SCREW, 1-1/2" long hex-hd cap |
| | 24 844 R1 | SCREW, 3-1/2" long hex-hd cap (2) |
| | 25 783 R1 | SCREW, 4" long NF hex-hd cap |
| | 25 775 R1 | SCREW, 2-1/4" long HF hex-hd cap |
| | 25 244 R1 | SCREW, 3-1/2" long NF hex-hd cap |
| | 25 223 R1 | NUT, hex (5) |
| | 25 896 R1 | WASHER, hardened (8) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 670 192 C11 | BODY ASSEMBLY, lubricating oil pump (See NOTE) |
| | 277 440 R11 | BODY w/DOWEL, 46 052 D |
| | 277 440 R11 | BODY, lubricating oil pump scavenging (See NOTE) |
| | 46 052 D | DOWEL, pump body |
| | 345 049 R1 | FLINGER, lubricating oil pump (See NOTE) |
| | 277 492 R1 | GASKET, water and lub oil pump |
| | 607 122 C21 | GEAR w/two BUSHING, 304 315 R1, idler (See NOTE) |
| | 607 121 C1 | GEAR, scavenging pump body (See NOTE) |
| | 670 190 C1 | GEAR, drive (See NOTE) |
| | 124 546 | KEY, 5/32 x 5/8" Woodruff (Lubricating oil and water pump drive gear)(See NOTE) |
| | 625 342 C1 | NUT (Lubricating oil and water pump drive gear) (See NOTE) |
| | 20 972 R1 | PLUG, water pump |
| | 444 687 | PLUG, 1/8" NPT hex-soc pipe (2) |
| | 701 169 C91 | SHAFT w/GEAR, lubricating oil (See NOTE) |
| | 670 193 C1 | SHAFT, oil pump idler |
| | 687 366 C91 | PACKAGE, water pump coolant seal field service (Consists of SEAL and SEAT) (Replaces 701 331 C93) |

NOTE: Refer to "Lubricating Oil Pump and Connections."



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**WATER PUMP, OIL COOLERS, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS – Continued (TD-25 C (Power Shift and Arctic), 330 and 340)**

**ENGINE VARIATIONS**

**(TD-25 C (Power Shift)**

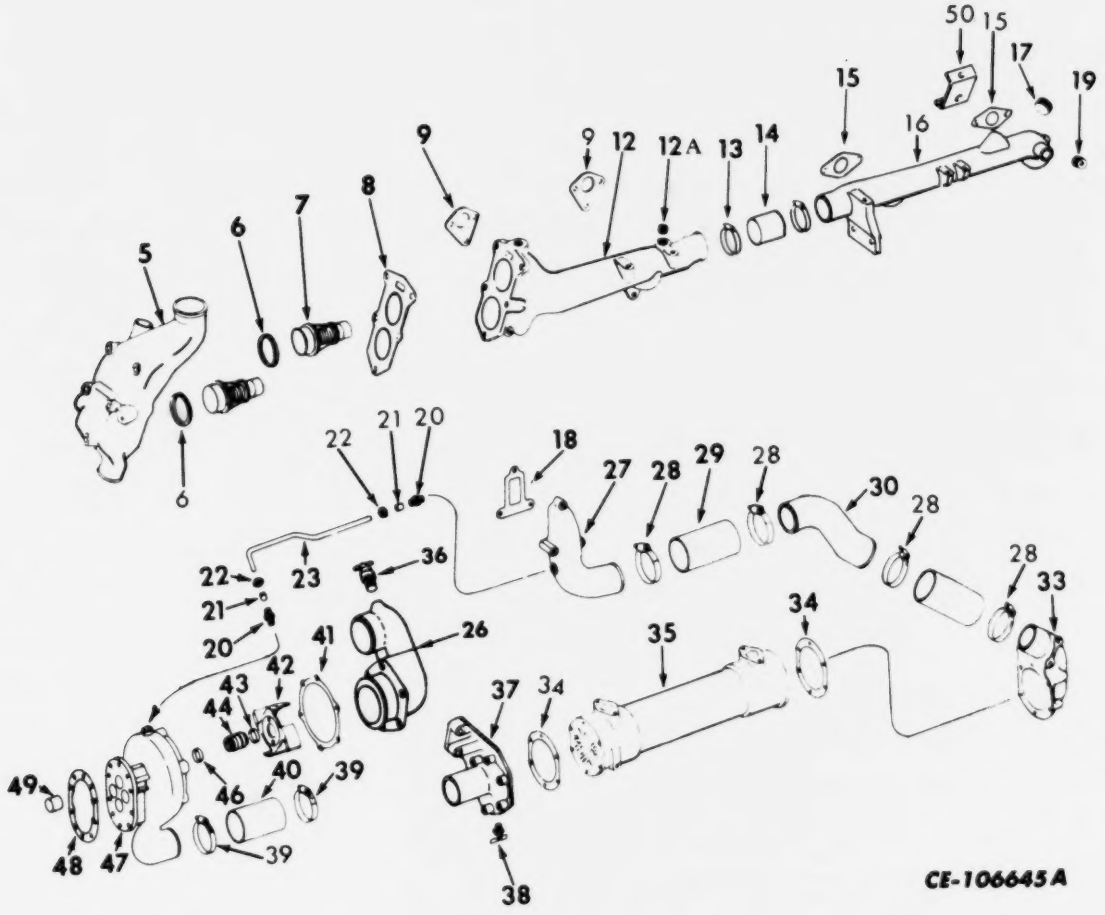
| | | |
|---|---|---|
| 1 | 346 755 R1 | HOSE, thermostat by-pass (Lower) |
| 3 | 701 190 C91 | PIPE, thermostat by-pass |
| | 25 492 R1 | SCREW, hex-hd cap |
| | 27 326 R1 | WASHER, hardened |
| 5 | 332 138 R1 | HOUSING, thermostat w/two SEAL, 310 947 R91 |
| | 25 522 R1 | NUT (2) |
| | 24 846 R1 | SCREW, hex-hd cap (3) |
| | 24 845 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (5) |
| 19 | 310 114 R11 | PIPE, radiator to water pump |
| 24 | 346 544 R1 | HOSE, radiator to water pump pipe |
| 48 | 603 510 C91 | COOLER, torque converter oil |
| | 24 842 R1 | SCREW, 1-3/4" long hex-hd cap (8) |
| | 257 804 R1 | SCREW, 3" long hex-hd cap (6) |
| | 24 845 R1 | SCREW, 4" long hex-hd cap |
| | 25 896 R1 | WASHER, hardened (15) |
| 55 | 670 842 C2 | BRACKET, L.H. rear air cleaner |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |

**(330 and 340)**

| | | |
|---|---|---|
| 1 | 346 756 R1 | HOSE, thermostat by-pass |
| 3 | 701 770 C1 | PIPE, thermostat by-pass |
| | 25 492 R1 | SCREW, hex-hd cap |
| | 27 326 R1 | WASHER, hardened |
| 5 | 670 553 R1 | HOUSING, thermostat w/two SEAL, 310 947 R91 |
| | 25 522 R1 | NUT (2) |
| | 24 846 R1 | SCREW, hex-hd cap (3) |
| | 24 845 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (5) |
| 19 | 303 977 R1 | PIPE, radiator to water pump |
| 24 | 346 543 R1 | HOSE, radiator to water pump pipe |
| 48 | 606 917 C91 | COOLER, torque converter oil |
| | 24 842 R1 | SCREW, 1-3/4" long hex-hd cap (8) |
| | 257 804 R1 | SCREW, 3" long hex-hd cap (6) |
| | 24 845 R1 | SCREW, 4" long hex-hd cap |
| | 25 896 R1 | WASHER, hardened (15) |
| 56 | 31 729 D | VALVE, 3/8" Type "C" drain (Water pump vent) |

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

**WATER PUMP, OIL COOLER, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS (TD-25 C (Gear Drive), H-100C and D-120C)**




| | | | | | |
|---|---|---|---|---|---|
| 5 | | (See Individual Engine Variation) | 12A | 444 588 | PLUG, 1/2" sq-hd pipe |
| 6 | 310 947 R91 | SEAL, thermostat (2) | 13 | 397 256 R1 | CLAMP, water manifold hose (2) |
| 7 | 324 391 R91 | THERMOSTAT (180° - 195°) (2) | 14 | 346 758 R1 | HOSE, water manifold |
| | or | | | | |
| 7 | 625 095 C1 | THERMOSTAT (180° - 202°) (2) | 15 | 279 384 R2 | GASKET, water manifold (2) |
| 8 | 316 112 R2 | GASKET, thermostat housing | 16 | 701 167 C92 | MANIFOLD w/PLUG, 444 678 and PLUG, 445 751 |
| 9 | 303 782 R1 | GASKET, front water manifold (2) | | 151 629 R1 | SCREW, hex-hd cap |
| | | | | 25 896 R1 | WASHER, hardened (4) |
| 12 | 320 104 R11 | MANIFOLD, front water | | | |
| | 24 847 R1 | SCREW, hex-hd | 17 | 444 678 | PLUG, 1" sq-soc pipe |
| | 140 483 H | SCREW, | | | |
| | 25 896 R1 | WASHER, hardened (8) | 18 | 278 794 R1 | GASKET, engine water inlet elbow |



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**WATER PUMP, OIL COOLER, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS – Continued (TD-25C (Gear Drive), H-100C and D-120C)**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 19 | 445 751 | PLUG, 1/2" sq-soc pipe |
| 20 | 278 098 R1 | CONNECTOR, water pump air bleed (1/4 x 3/8") (2) |
| 21 | 277 741 R2 | SLEEVE, water pump air bleed (2) |
| 22 | 277 742 R1 | NUT, water pump air bleed (2) |
| 23 | 278 987 R2 | PIPE, water pump air bleed |
| 26 | 318 171 R11 | ELBOW w/PLUG, 20 972 R1, water pump inlet |
| | 24 840 R1 | SCREW, hex-hd cap |
| | 277 232 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (5) |
| 27 | 278 793 R1 | ELBOW, engine water inlet |
| | 24 621 R1 | SCREW, hex-hd cap (2) |
| | 24 842 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (3) |
| 28 | 401 345 R1 | CLAMP, engine water inlet elbow hose (4) |
| 29 | 346 755 R1 | HOSE, engine water inlet elbow (2) |
| 30 | 308 472 R1 | PIPE, engine water inlet |
| 33 | 310 106 R1 | HEADER, engine oil cooler water outlet |
| | 25 296 R1 | SCREW, hex-hd cap (2) |
| | 26 273 R1 | WASHER, hardened (2) |
| 34 | 278 985 R1 | GASKET, engine oil cooler (2) |
| 35 | 310 097 R91 | COOLER, lubricating oil |
| | 24 621 R1 | SCREW, 2-1/4" long hex-hd cap (2) |
| | 24 844 R1 | SCREW, 3-1/2" long hex-hd cap (2) |
| | 24 842 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (2) |
| 36 | 31 729 D | VALVE, water pump vent |
| 37 | 310 103 R1 | HEADER, engine oil cooler water inlet |
| | 24 864 R1 | SCREW, hex-hd cap (2) |
| | 26 273 R1 | WASHER, hardened (2) |
| 38 | 31 729 D | VALVE, 3/8" Type "C" drain |
| 39 | 401 345 R1 | CLAMP, water pump outlet hose (2) |
| 40 | 346 756 R1 | HOSE, water pump outlet |
| 41 | 277 491 R1 | GASKET, water pump inlet elbow |
| 42 | 310 095 R1 | IMPELLER, water pump |
| 43 | | SEAL, water pump seal (Order PACKAGE, 687 366 C91) |
| 44 | | SEAL, water pump coolant (Order PACKAGE, 687 366 C91) |
| 46 | 317 847 R91 | SEAL, water pump oil |
| 47 | 674 243 C91 | HOUSING w/two PLUG, 444 687 and BUSHING, 303 939 R1, water pump |
| | 103 026 | NUT (8) |
| | 103 321 | WASHER, lock (8) |
| 48 | 277 525 R2 | GASKET, water pump housing |
| 49 | 303 939 R1 | BUSHING, water pump body |
| 50 | | (See Individual Engine Variation) |
| | 277 492 R2 | GASKET, pump body |
| | 444 654 | PLUG, 1/4" pipe (Cooler outlet header) |
| | 444 687 | PLUG, 1/8"NPT hex-soc pipe (2) |
| | 20 972 R1 | PLUG, 3/8" sq-hd steel pipe |
| | 20 987 R1 | PLUG, 1/2" sq-soc pipe (Brass) |
| | 444 751 | PLUG, 1/2" sq-soc pipe |
| | 701 168 C94 | PUMP ASSEMBLY, water and lubricating oil (Composed of |
| | | 1 BODY 670 192 C11 |
| | | 1 BODY 277 440 R11 |
| | | 1 FLINGER 345 049 R1 |
| | | 2 GASKET 277 525 R2 |
| | | 1 GEAR 607 122 C11 |
| | | 1 GEAR 607 121 C1 |
| | | 1 GEAR 670 190 C1 |
| | | 1 GEAR 607 220 C11 |
| | | 1 HOUSING 674 243 C91 |
| | | 1 IMPELLER 310 095 R1 |
| | | 1 KEY 124 546 |
| | | 1 NUT 625 342 C1 |
| | | 1 PAMPHLET 1 014 780 R1 |
| | | 1 SEAL 317 847 R91 |
| | | 1 SEAT 684 432 C1 |
| | | 1 PACKAGE 687 366 C91 |
| | | 1 SHAFT 701 169 C1 ) |
| | 24 841 R1 | SCREW, 1-1/2" long hex-hd cap |
| | 25 775 R1 | SCREW, 2-1/4" long hex-hd cap |
| | 24 844 R1 | SCREW, 3-1/2" long hex-hd cap (2) |
| | 25 244 R1 | SCREW, 3-1/2" long NF hex-hd cap |
| | 25 783 R1 | SCREW, 4" long hex-hd cap |
| | 25 523 R1 | NUT (5) |
| | 25 896 R1 | WASHER, hardened (8) |
| | 687 366 C91 | PACKAGE, water pump coolant seal (Consists of SEAL and SEAT) (Replaces 701 331 C93) |
| | 304 315 R1 | BUSHING, idler gear |
| | 670 192 C11 | BODY, lubricating oil pump |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**WATER PUMP, OIL COOLER, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS – Continued (For TD-25C (Gear Drive) H-100C and D-120C)**

| | | |
|---|---|---|
| | 277 440 R11 | BODY, lubricating oil pump scavenging (See NOTE) |
| | 345 049 R1 | FLINGER, lubricating oil pump (See NOTE) |
| | 607 122 C21 | GEAR, idler w/two BUSHING, 304 315 R1 (See NOTE) |
| | 670 121 C1 | GEAR, scavenging pump body (See NOTE) |
| | 670 190 C1 | GEAR, drive (See NOTE) |
| | 124 546 | KEY, Woodruff (See NOTE) |
| | 624 534 C1 | NUT, lubricating oil pump drive gear (See NOTE) |
| | 701 169 C1 | SHAFT w/GEAR, lubricating oil |

**ENGINE VARIATIONS**

**(H-100C and D-120C)**

| | | |
|---|---|---|
| 5 | 320 103 R1 | HOUSING, thermostat w/two SEAL, 310 947 R1 and PLUG, 445 751 |
| | 25 522 R1 | NUT (2) |
| | 24 846 R1 | SCREW, hex-hd cap (3) |
| | 24 845 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (5) |

**(TD-25C (Gear Drive)**

| | | |
|---|---|---|
| 5 | 332 138 R1 | HOUSING, thermostat w/two SEAL, 310 947 R1 and PLUG, 445 751 |
| | 25 522 R1 | NUT (2) |
| | 24 846 R1 | SCREW, hex-hd cap (3) |
| | 24 845 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (5) |
| 50 | 670 842 C2 | BRACKET, L.H. rear air cleaner |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |

NOTE: Refer to "Lubricating Oil Pump."



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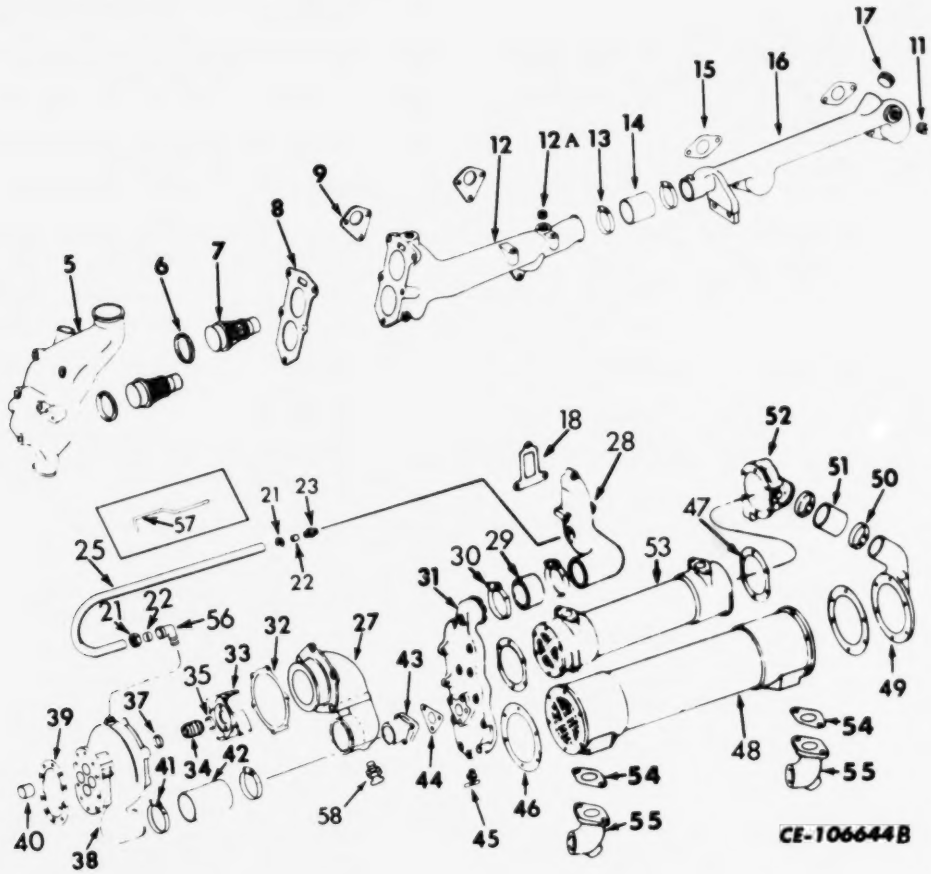
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## WATER PUMP, OIL COOLERS, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS (For 560)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 5 | 320 103 R1 | HOUSING, thermostat |
| | 25 522 R1 | NUT (2) |
| | 24 845 R1 | SCREW, hex-hd cap (2) |
| | 24 846 R1 | SCREW, hex-hd cap (3) |
| | 25 896 R1 | WASHER, hardened (5) |
| 6 | 310 947 R91 | SEAL, thermostat (2) |
| 7 | 324 391 R91 | THERMOSTAT (180° - 195°) (2) |
| | OR | |
| 7 | 625 095 C1 | THERMOSTAT (180°-202°) (2) |
| 8 | 316 112 R2 | GASKET, thermostat housing |
| 9 | 303 782 R1 | GASKET, front water manifold (2) |
| 12 | 320 104 R2 | MANIFOLD, front water |
| | 20 063 R1 | SCREW, 5" long hex-hd cap |
| | 140 483 H | SCREW, 1-1/4" long hex-hd cap (5) |
| | 25 896 R1 | WASHER, hardened (6) |
| 12A | 444 588 | PLUG, 1/2" sq-hd pipe |
| 13 | 397 256 R1 | CLAMP, water manifold hose (2) |
| 14 | 346 758 R1 | HOSE, water manifold (2-1/4 x 2-5/8 x 2-1/2" long) |
| 15 | 279 384 R2 | GASKET, water manifold rear (2) |
| 16 | 701 167 C92 | MANIFOLD w/PLUG, 444 678 and PLUG, 445 751, rear water |
| | 151 629 R1 | SCREW, hex-hd cap (4) |
| | 25 896 R1 | WASHER, hardened (4) |
| 17 | 444 678 | PLUG, 1" sq-soc pipe |
| 18 | 278 794 R1 | GASKET, engine water inlet elbow |
| 21 | 277 742 R1 | NUT, water pump air bleed (2) |
| 22 | 277 741 R2 | SLEEVE, water pump air bleed (2) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **WATER PUMP, OIL COOLERS, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS - Continued (For 560)** | | |
| 23 | 278 098 R1 | CONNECTOR, water pump air bleed (1/4 x 3/8")(One used w/PIPE, 308 003 R2 and two used w/PIPE, 278 987 R2) |
| 25 | 308 003 R2 | PIPE, water pump air bleed 11675 and up |
| 27 | 318 171 R11 | ELBOW w/PLUG, 20 972 R1, water pump inlet |
| | 24 840 R1 | SCREW, hex-hd cap (4) |
| | 277 232 R1 | SCREW, hex-hd cap (8) |
| | 25 896 R1 | WASHER, hardened (5) |
| 28 | 318 123 R11 | ELBOW w/PLUG, 444 576, engine water inlet |
| | 24 621 R1 | SCREW, hex-hd cap (2) |
| | 24 842 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (3) |
| 29 | 346 755 R1 | HOSE, engine water inlet elbow (2-1/4 x 2-5/8 x 3-1/4" long) |
| 30 | 401 345 R1 | CLAMP, engine water inlet elbow hose (2) |
| 31 | 318 124 R1 | HEADER, engine and torque converter oil cooler |
| | 24 864 R1 | SCREW, hex-hd cap (2) |
| | 26 273 R1 | WASHER, hardened (2) |
| 32 | 277 491 R1 | GASKET, water pump inlet elbow |
| 33 | 310 095 R1 | IMPELLER, water pump |
| 34 | | SEAL, water pump coolant (Order PACKAGE, 687 366 C91) |
| 35 | | SEAT, water pump seal (Order PACKAGE, 687 366 C91) |
| 37 | 317 847 R91 | SEAL, water pump oil |
| 38 | 674 243 C91 | HOUSING w/two PLUG, 444 687 and BUSHING, 303 939 R1, water pump |
| | 25 674 R1 | NUT (8) |
| | 25 896 R1 | WASHER, hardened (8) |
| 39 | 277 525 R2 | GASKET, water pump housing (2) |
| 40 | 303 939 R1 | BUSHING, water pump body |
| 41 | 401 345 R1 | CLAMP, water pump outlet hose (2) |
| 42 | 346 754 R1 | HOSE, water pump outlet 11674 and below |
| 42 | 346 757 R1 | HOSE, water pump outlet 11675 and up |
| 43 | 308 470 R1 | CONNECTOR, header water inlet |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 24 846 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (3) |
| 44 | 308 471 R1 | GASKET, header water inlet connector |
| 45 | 31 729 D | VALVE, 3/8" Type "C" drain |
| 46 | 330 251 R1 | GASKET, torque converter cooler (2) |
| 47 | 278 985 R1 | GASKET, engine oil cooler (2) |
| 48 | 603 510 C91 | COOLER, torque converter oil |
| | 24 842 R1 | SCREW, hex-hd cap (8) |
| | 275 804 R1 | SCREW, hex-hd cap (6) |
| | 24 845 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (15) |
| 49 | 340 703 R1 | HEADER, torque converter cooler rear outlet |
| | 25 689 R1 | SCREW, hex-hd cap (8) |
| | 444 654 | PLUG, sq-soc-hd pipe (2) |
| | 25 296 R1 | SCREW, hex-hd cap |
| | 26 273 R1 | WASHER, hardened (2) |
| 50 | 397 256 R1 | CLAMP, engine oil cooler water outlet hose (2) |
| 51 | 346 759 R1 | HOSE, engine oil cooler water outlet (2-1/2 x 2-7/8 x 4") |
| 52 | 310 107 R91 | HEADER, engine oil cooler water rear outlet |
| | 24 864 R1 | SCREW, 2" long hex-hd cap (8) |
| | 25 296 R1 | SCREW, 6-1/2" long hex-hd cap (8) |
| | 26 273 R1 | WASHER, hardened (2) |
| 53 | 310 097 R91 | COOLER, lubricating oil |
| | 140 483 H | SCREW, 1-1/4" long hex-hd cap |
| | 24 842 R1 | SCREW, 1-3/4" long hex-hd cap |
| | 275 804 R1 | SCREW, 3" long hex-hd cap (5) |
| | 24 845 R1 | SCREW, 4" long hex-hd cap |
| | 25 896 R1 | WASHER, hardened (12) |
| 54 | 309 559 R1 | GASKET, torque converter oil cooler manifold (2) |
| 55 | 331 894 R21 | MANIFOLD, torque converter oil cooler (2) |
| | 24 840 R1 | SCREW, hex-hd cap (4) |
| | 25 896 R1 | WASHER, hardened (4) |
| 56 | 278 837 R1 | ELBOW, air bleed pipe (Used w/ PIPE, 308 003 R2) |
| 57 | 278 987 R2 | PIPE, water pump air bleed 11674 and below |
| 58 | 31 729 D | VALVE, 3/8" Type "C" drain (Water pump vent) |



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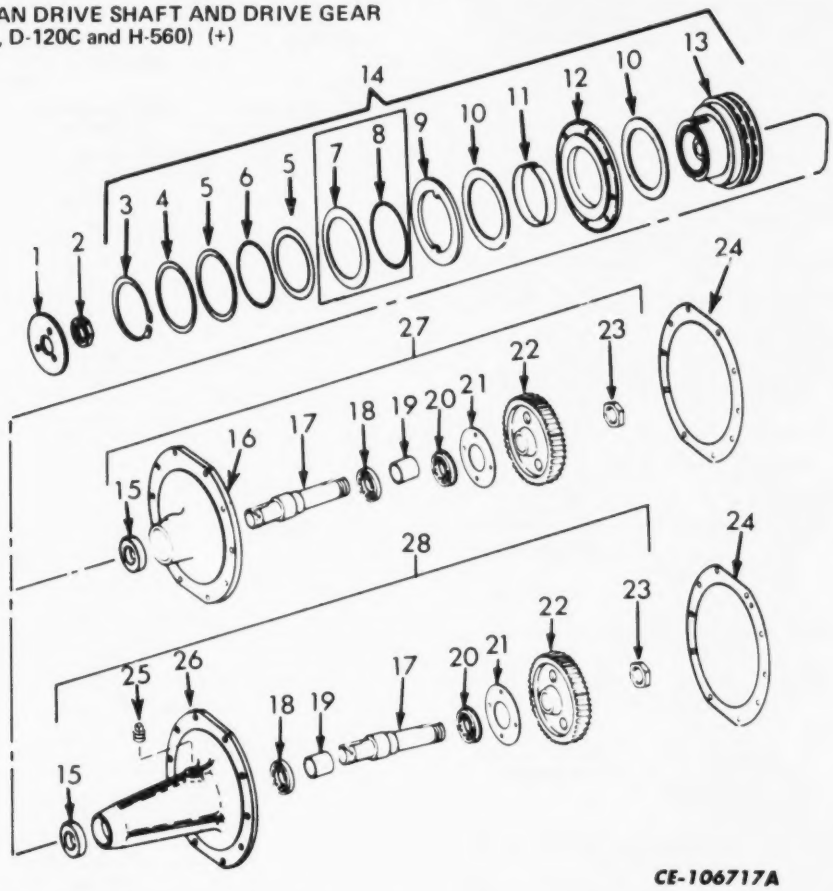
**WATER PUMP, OIL COOLERS, WATER MANIFOLD, THERMOSTATS AND RELATED PARTS - Continued (For 560)**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 670 192 C11 | BODY ASSEMBLY, lubricating oil pump (See NOTE) 11674 and below |
| | 701 283 C91 | BODY, lubricating oil pump scavenging (See NOTE) 11675 and up |
| | 345 049 R1 | FLINGER, lubricating oil pump (See NOTE) |
| | 277 492 R2 | GASKET, lubricating oil and water pump (See NOTE) |
| | 607 121 C2 | GEAR, lubricating oil scavenging pump body (See NOTE) 11674 and below |
| | 670 122 C1 | GEAR w/two BUSHING, 304 315 R1, lubricating oil scavenging pump idler (See NOTE) 11674 and below |
| | 670 190 C1 | GEAR, drive (See NOTE) |
| | 607 220 C21 | GEAR w/two BUSHING, 304 315 R1, oil pump body idler (See NOTE) |
| | 124 546 | KEY, 5/32 x 5/8" Woodruff (Lubricating oil and water pump drive gear) (See NOTE) |
| | 625 342 C1 | NUT, lubricating oil and water pump drive gear) (See NOTE) |
| | 277 440 R11 | BODY, lubricating oil pump scavenging (See NOTE) 11674 and below |
| | 687 366 C91 | PACKAGE, water pump coolant seal (Consists of SEAL and SEAT) (Replaces 701 331 C93) |
| | 9 409 949 | PLUG, 3/4" NPT pipe |
| | 444 576 | PLUG, 1/4" sq-hd stl. pipe (2) |
| | 445 751 | PLUG, 1/2" sq-soc pipe (2) |
| | 20 972 R1 | PLUG, 3/8" sq-hd pipe |
| | 20 987 R1 | PLUG, 1/2" sq-soc pipe (Brass) |
| | 444 687 | PLUG, 1/8" NPT hex-soc pipe (2) |
| | 701 168 C94 | PUMP ASSEMBLY, water and lubricating oil (Scavenging) (See NOTE) 11674 and below (Composed of 1 BODY 670 192 C11; 1 BODY 277 440 R11; 1 FLINGER 345 049 R1; 2 GASKET 277 525 R2; 1 GEAR 670 190 C1; 1 GEAR 607 121 C1; 1 GEAR 607 122 C1; 1 GEAR 607 220 C11; 1 HOUSING 674 243 C91; 1 IMPELLER 310 095 R1; 1 KEY 124 546; 1 NUT 625 342 C1; 1 PACKAGE 687 366 C91; 1 PAMPHLET 1 014 780 R1; 1 SEAL 317 847 R91; 1 SEAT 684 432 C1; 1 SHAFT 701 169 C1 ) |
| | 701 282 C94 | PUMP ASSEMBLY, water and lubricating oil (Non-Scavenging) (See NOTE) 11675 and up (Composed of - 1 BODY 701 283 C91; 1 FLINGER 345 049 R1; 2 GASKET 277 525 R2; 1 GEAR 670 190 C1; 1 GEAR 607 220 C11; 1 HOUSING 674 243 C91; 1 IMPELLER 310 095 R1; 1 KEY 124 546; 1 NUT 625 342 C1; 1 PACKAGE 687 366 C91; 1 PAMPHLET 1 014 780 R1; 1 SEAL 317 847 R91; 1 SEAT 684 432 C1; 1 SHAFT 701 284 C91 ) |
| | 24 841 R1 | SCREW, 1-1/2" long hex-hd cap |
| | 25 775 R1 | SCREW, 2-1/4" long hex-hd cap |
| | 24 844 R1 | SCREW, 3-1/2" long hex-hd cap (2) |
| | 25 244 R1 | SCREW, 3-1/2" long NF hex-hd cap |
| | 25 783 R1 | SCREW, 4" long hex-hd cap |
| | 25 523 R1 | NUT (5) |
| | 25 896 R1 | WASHER, hardened (8) |
| | 701 284 C91 | SHAFT w/GEAR, lubrication oil (See NOTE) |

NOTE: Refer to "Lubricating Oil Pump and Connections."

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

FAN PULLEY, FAN DRIVE SHAFT AND DRIVE GEAR
(TD-25C, H-100C, D-120C and H-560) (+)

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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 690 113 C91 | DRIVE ASSEMBLY, fan (Composed of Ref. Nos. 14 and 28) (TD-25C) |
| | 670 839 C95 | DRIVE ASSEMBLY, fan (Composed of Ref. Nos. 14 and 27) (H-100C and D-120C) |
| | 673 018 C96 | DRIVE ASSEMBLY, fan (Composed of Ref. Nos. 14 and 27) (H-560) |
| 1 | 313 853 R2 | PLATE, fan drive mounting |
| | 278 771 R1 | LOCK, bolt (3) |
| | 25 281 R1 | SCREW, hex-hd cap (3) |
| 2 | 625 345 C1 | NUT, fan mounting |
| 3 | 317 736 R1 | RING, snap |
| 4 | 317 737 R1 | SPACER, flange (Order two SPRING, 690 025 C1 and SPACER, 690 026 C1) |
| 4 | 317 740 R1 | SPACER, flange |
| 5 | 317 738 R1 | SPACER, flange (Order two SPRING, 690 025 C1 and SPACER, 690 026 C1) |
| 5 | 690 025 C1 | SPRING, belleville (2) |
| 6 | 317 739 R1 | SPACER, flange (Order two SPRING, 690 025 C1 and SPACER, 690 026 C1) |
| 6 | 690 026 C1 | SPACER, belleville |
| 7 | 631 678 C1 | SPACER, flange mounting (Order two SPRING, 690 025 C1 and SPACER, 690 026 C1) |
| 8 | 317 739 R1 | SPACER, flange (Order two SPRING, 690 025 C1 and SPACER, 690 026 C1) |
| 9 | 317 742 R1 | PLATE, pressure |
| 10 | 317 743 R1 | PLATE, friction facing (2) |

(+) Refer to Section 6, "AIR COMPRESSOR AND ALTERNATOR DRIVE AND RELATED PARTS" for Fan Pulley for 330 and 340.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FAN PULLEY, FAN DRIVE SHAFT AND DRIVE GEAR - Continued** |
| | | (TD-25C, H-100C, D-120C and H-560) (+) |
| 11 | 690 027 C1 | BEARING, friction (Replaces 317 744 R1) |
| 12 | | (See Individual Engine Variation) |
| 13 | | (See Individual Engine Variation) |
| 14 | | (See Individual Engine Variation) |
| 15 | | (See Individual Engine Variation) |
| 16 | | (See Individual Engine Variation) |
| 17 | | (See Individual Engine Variation) |
| 18 | | (See Individual Engine Variation) |
| 19 | | (See Individual Engine Variation) |
| 20 | 681 626 C91 | BEARING, rear |
| 21 | 310 123 R2 | RETAINER, bearing |
| | 20 834 R1 | SCREW, hex-hd cap (4) |
| | 277 788 R1 | LOCK, bolt |
| 22 | | (See Individual Engine Variation) |
| 23 | 26 577 R1 | NUT, jam |
| 24 | 279 700 R1 | GASKET, fan drive housing |
| 25 | | (See Individual Engine Variation) |
| 26 | | (See Individual Engine Variation) |
| 27 | | (See Individual Engine Variation) |
| 28 | | (See Individual Engine Variation) |

## ENGINE VARIATIONS

### (TD-25C)

| | | |
|---|---|---|
| 12 | 317 745 R1 | FLANGE, fan mount |
| 13 | 634 061 C2 | PULLEY and COUPLING, flange mounting |
| 14 | 702 591 C94 | FAN MOUNTING ASSEMBLY w/PULLEY |
| 15 | 953 019 R1 | SEAL, oil |
| 17 | 680 583 C1 | SHAFT |
| 18 | 683 167 C91 | BEARING, front |
| 19 | 332 072 R1 | SPACER, bearing |
| 22 | 279 702 R4 | GEAR, drive (46T) |
| 25 | 444 588 | PLUG, pipe |
| 26 | 670 838 C2 | HOUSING, fan drive |
| 28 | 670 837 C94 | HOUSING ASSEMBLY, fan drive |
| | 25 523 R1 | NUT, hex (2) |
| | 25 786 R1 | SCREW, hex-hd cap (2) |
| | 140 483 H | SCREW, hex-hd cap (6) |
| | 25 896 R1 | WASHER, hardened (10) |

### (For H-100C and D-120C)

| | | |
|---|---|---|
| 12 | 317 745 R1 | FLANGE, fan mount |
| 13 | 634 061 C2 | PULLEY and COUPLING, flange mounting |
| 14 | 702 591 C94 | FAN MOUNTING ASSEMBLY w/ PULLEY |
| 15 | 324 732 R91 | SEAL, oil |
| 16 | 670 749 C2 | HOUSING, fan drive |
| 17 | 680 582 C1 | SHAFT |
| 18 | 683 166 C91 | BEARING, front |
| 19 | 279 703 R3 | SPACER, bearing |
| 22 | 310 119 R4 | GEAR, drive (40T) |
| 27 | 670 748 C94 | HOUSING ASSEMBLY, fan drive |
| | 25 523 R1 | NUT (2) |
| | 140 483 H | SCREW, hex-hd cap (6) |
| | 25 896 R1 | WASHER, hardened (8) |

### (H-560)

| | | |
|---|---|---|
| 12 | 631 111 C1 | FLANGE, fan mount |
| 13 | 634 063 C2 | PULLEY and COUPLING, flange mounting |
| 14 | 674 689 C94 | FAN MOUNTING ASSEMBLY w/ PULLEY |
| 15 | 324 732 R91 | SEAL, oil |
| 16 | 279 699 R2 | HOUSING, fan drive |
| 17 | 680 582 C1 | SHAFT |
| 18 | 683 166 C91 | BEARING, front |
| 19 | 279 703 R3 | SPACER, bearing |
| 22 | 279 702 R4 | GEAR, drive (46T) |
| 27 | 673 017 C94 | HOUSING ASSEMBLY, fan drive |
| | 25 523 R1 | NUT, hex (2) |
| | 140 483 H | SCREW, hex-hd cap (6) |
| | 25 896 R1 | WASHER, hardened |

(+) - Refer to Section 6, "AIR COMPRESSOR AND ALTERNATOR DRIVE AND RELATED PARTS" for Fan Pulley for 330 and 340.

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

# CRANKCASE 6

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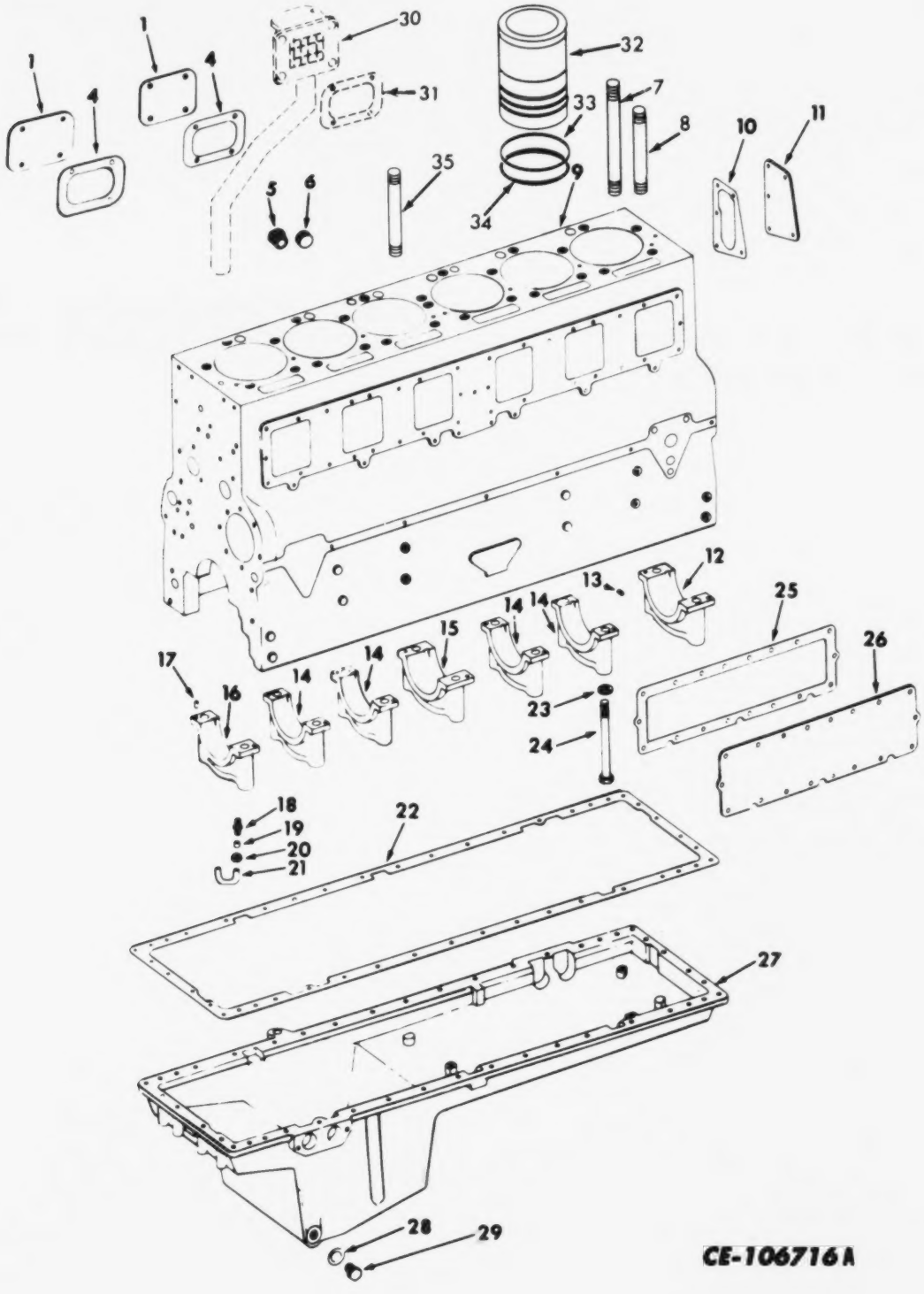
## CRANKCASE, OIL PAN AND RELATED PARTS



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CRANKCASE, OIL PAN AND RELATED PARTS – Continued** |
| 1 | 279 712 R1 | COVER, crankcase side (2) |
| | 24 840 R1 | SCREW, hex-hd cap (4) |
| | 25 896 R1 | WASHER, hardened (4) |
| 4 | 279 713 R1 | GASKET, crankcase side cover (2) |
| 5 | 192 085 | BUSHING, reducing pipe |
| 6 | 21 502 R1 | PLUG, sq-soc pipe (Steel)(3) |
| | or | |
| 6 | 20 976 R1 | PLUG, sq-soc-hd pipe (Cast iron) (3) |
| 7 | 279 799 R1 | STUD, cylinder head (Long)(12) |
| 8 | 279 798 R1 | STUD, cylinder head (short) (13) - 13063 and below (12) - 13064 and up |
| 9 | 687 106 C91 | CRANKCASE ASSY. (Less sleeves) (Together w/CRAB ASSY, 687 595 C91 and WASHER, 687 589 C1 will work for CRANKCASE ASSY 670 544 C91) (Composed of - |
| | | 6 BEARING 277 785 R1 |
| | | 1 BUSHING 179 400 |
| | | 1 BUSHING 192 085 |
| | | 1 CAP 305 800 R1 |
| | | 4 CAP 305 801 R1 |
| | | 1 CAP 305 802 R1 |
| | | 1 CAP 305 803 R1 |
| | | § 1 CRANKCASE |
| | | 4 DOWEL 19 968 R1 |
| | | 14 DOWEL 20 031 R1 |
| | | 4 DOWEL 20 556 R1 |
| | | 4 "O" RING 601 098 C1 |
| | | 2 "O" RING 360 610 R1 |
| | | 5 PLUG 50 410 DA |
| | | 2 PLUG 50 474 DA |
| | | 3 PLUG 445 684 |
| | | 1 PLUG 444 678 |
| | | 1 PLUG 444 660 |
| | | 1 PLUG 444 654 |
| | | 2 PLUG 9 409 949 |
| | | 3 PLUG 21 502 R1 |
| | | 4 PLUG 41 600 D |
| | | 4 PLUG 277 779 R1 |
| | | 2 PLUG 277 780 R1 |
| | | 1 PLUG 320 272 R1 |
| | | 1 RETAINER 323 998 R1 |
| | | 14 SCREW 277 819 R1 |
| | | 1 STUD 687 588 C2 |
| | | 12 STUD 279 798 R1 |
| | | 12 STUD 279 799 R1 |
| | | 14 WASHER 39 422 D ) |
| | 24 830 R1 | SCREW, hex-hd cap (6) |
| | 179 875 | SCREW, hex-hd cap |
| | 116 105 | WASHER, 17/32 x 1-1/16" x No. 13 ga. (Copper) |
| | 116 103 | WASHER, 13/32 x 13/16" x .051" (Copper)(6) |
| 10 | 279 724 R1 | GASKET, crankcase rear cover |
| 11 | 279 723 R1 | COVER, crankcase rear |
| | 24 840 R1 | SCREW, hex-hd cap (5) |
| | 25 896 R1 | WASHER, hardened (5) |
| 12 | 305 803 R1 | CAP, crankshaft thrust bearing |
| 13 | 50 410 DA | PLUG, crankcase oil header pipe (5) |
| 14 | 305 801 R1 | CAP, intermediate crankshaft bearing (4) |
| 15 | 305 802 R1 | CAP, center crankshaft bearing |
| 16 | 305 800 R1 | CAP, front crankshaft bearing |
| 17 | 20 031 R1 | DOWEL, crankshaft bearing cap (14) |
| 18 | 278 039 R1 | CONNECTOR, gear oil jet tube (2) |
| 19 | 278 040 R2 | SLEEVE, gear oil jet tube (2) |
| 20 | 278 041 R1 | NUT, gear oil jet tube (2) |
| 21 | 277 951 R1 | TUBE, gear oil jet |
| 22 | 279 857 R2 | GASKET, crankcase oil pan |
| 23 | 39 422 D | WASHER, crankshaft bearing cap capscrew (14) |
| 24 | 277 819 R1 | SCREW, cap (Crankshaft bearing cap) (14) |
| 25 | 349 456 R1 | GASKET, push rod chamber cover (2) |
| 26 | 349 455 R1 | COVER, push rod chamber (2) |
| | 24 839 R1 | SCREW, hex-hd cap (31) |
| | 25 896 R1 | WASHER, hardened (33) |
| 27 | | (See Individual Engine Variations) |
| 28 | 59 658 D | GASKET, oil pan drain plug (3) |
| 29 | 445 096 | PLUG, oil pan drain (3) |
| 30 | | PIPE, breather (Refer to "Emission Control") |
| 31 | | GASKET, breather (Refer to "Emission Control") |
| 32 | | SLEEVE, cylinder (Refer to "Connecting Rods and Pistons") |
| 33 | | SHIM, cylinder sleeve (Refer to "Connecting Rods and Pistons") |
| 34 | | RING, cylinder sleeve (Refer to "Connecting Rods and Pistons") |
| 35 | 687 588 C2 | STUD, center crab washer 13064 and Up |

§ – Not Furnished Separately.

CRANKCASE, OIL PAN AND RELATED PARTS – Continued

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 179 400 | BUSHING, 1-1/2 x 1" reducing pipe |
| | 19 968 R1 | DOWEL, crankcase front cover (2) |
| | 19 968 R1 | DOWEL, flywheel housing (2) |
| | 20 031 R1 | DOWEL, cylinder head (4) |
| | 20 556 R1 | DOWEL, fan idler shaft (2) |
| | 20 556 R1 | DOWEL, hydraulic pump idler shaft (2) |
| | 615 468 C1 | INSERT, crankcase |
| | 678 043 C1 | INSERT, crankcase sleeve counterbore |
| | 601 098 C1 | "O" RING (1/8 x 3/4 x 1") (4) |
| | 360 610 R1 | "O" RING (1/8 x 1-5/8 x 1-7/8")(2) |
| | 41 600 D | PLUG, cup (Crankcase top deck)(4) |
| | 50 474 DA | PLUG, crankcase oil header pipe (2) |
| | 444 660 | PLUG, 3/8" sq-soc pipe (In crankcase) |
| | 444 654 | PLUG, 1/4" sq-soc pipe (In crankcase) |
| | 9 409 949 | PLUG, 3/4" sq-soc pipe (In crankcase) (2) |
| | 9 409 949 | PLUG, clean out pipe |
| | 277 779 R1 | PLUG, oil gallery (4) |
| | 277 780 R1 | PLUG, cooling jacket "O" ring (2) |
| | 445 684 | PLUG, 1/8" sq-hd pipe (3) |
| | 444 678 | PLUG, 1" sq-soc-pipe (In crankcase) |
| | 271 848 R1 | PLUG, clean-out pipe |
| | 320 272 R1 | PLUG, hydraulic pump idler bearing oil metering |
| | 323 998 R1 | RETAINER, oil gallery plug<br>SCREW, 1/2 x 3/4" hex-hd cap (2) |
| | 687 090 C1 | HELI-COIL (x) |
| | 332 662 R94 | PACKAGE, crankcase gasket (Consists of the following parts - |
| | 13 841 D | GASKET, lubricating oil filter case (3) |
| | 59 658 D | GASKET, oil pan drain plug (3) |
| | 105 454 | GASKET, injector fuel return fitting (2) |
| | 105 454 | GASKET, valve housing elbow (2) |
| | 105 454 | GASKET, valve housing fitting (6) |
| | 120 428 | GASKET, lubricating oil pump safety valve nut |
| | 120 428 | GASKET, lubricating oil filter by-pass valve nut |
| | 120 428 | GASKET, lubricating oil pressure regulating valve nut |
| | 277 491 R1 | GASKET, water pump inlet elbow |
| | 277 492 R2 | GASKET, lubricating oil pump body |
| | 277 525 R2 | GASKET, water pump housing |
| | 277 525 R2 | GASKET, lubricating oil scavenging pump body |
| | 349 456 R1 | GASKET, push-rod chamber cover (2) |
| | 277 803 R2 | GASKET, crankshaft rear oil seal face plate |
| | 277 806 R1 | GASKET, crankcase front plate |
| | 277 816 R1 | GASKET, crankcase front cover |
| | 278 270 R2 | GASKET, injection pump timing cover |
| | 278 467 R1 | GASKET, lubricating oil pressure regulating valve body |
| | 278 474 R1 | GASKET, crankcase oil pan cover (2) |
| | 278 596 R4 | GASKET, flywheel housing |
| | 278 603 R1 | GASKET, oil filler elbow |
| | 278 792 R1 | GASKET, lubricating oil cooler water outlet elbow |
| | 278 794 R1 | GASKET, engine water inlet elbow |
| | 278 816 R1 | GASKET, injection pump adapter |
| | 278 848 R1 | GASKET, injection pump |
| | 278 977 R1 | GASKET, tachometer drive bracket or service recorder |
| | 278 984 R1 | GASKET, engine oil cooler header (2) |
| | 278 985 R1 | GASKET, torque converter cooler header (2) |
| | 279 384 R2 | GASKET, lube oil cooler outlet elbow |
| | 279 700 R1 | GASKET, fan drive housing |
| | 279 704 R1 | GASKET, hydraulic pump hole cover |
| | 279 713 R1 | GASKET, crankcase side cover (2) |
| | 279 713 R1 | GASKET, crankcase breather |
| | 279 724 R1 | GASKET, crankcase rear cover |
| | 279 781 R1 | GASKET, fuel filter case (2) |
| | 671 383 C1 | GASKET, breather housing cover |

(x) – As Required.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CRANKCASE, OIL PAN AND RELATED PARTS – Continued** |
| | 672 784 C1 | GASKET, lubricating oil pump suction pipe elbow |
| | 279 857 R2 | GASKET, oil pan |
| | 303 387 R1 | GASKET, flywheel housing cover plate |
| | 345 462 R1 | GASKET, flywheel housing cover plate |
| | 304 573 R1 | GASKET, cranking motor flange |
| | 316 226 R16 | GASKET, flywheel housing cover |
| | 318 424 R1 | GASKET, crankshaft rear oil seal |
| | 320 122 R1 | GASKET, intercooler tube flange (2) |
| | 320 123 R1 | GASKET, intercooler (2) |
| | 323 815 R1 | GASKET, flywheel housing |
| | 330 251 R1 | GASKET, torque converter cooler header (2) |
| | 670 249 C1 | GASKET, injection pump |
| | 670 361 C1 | GASKET, intercooler upper |
| | 670 362 C1 | GASKET, intercooler lower |
| | 682 906 C1 | GASKET, transfer pump cover |
| | 252 483 R1 | "O" RING, oil scavenging pump manifold |
| | 687 010 C1 | "O" RING, piston coolant jet (Small) (6) |
| | 293 739 R1 | "O" RING, oil scavenging pump manifold (3) |
| | 343 901 R1 | "O" RING, fuel transfer pump |
| | 601 098 C1 | "O" RING, oil gallery (4) |
| | 352 216 R1 | "O" RING, clutch pilot grease retainer |
| | 343 396 R2 | "O" RING, piston coolant jet (Large) (6) |
| | 360 610 R1 | "O" RING, cooling jacket (3) |
| | 371 544 R1 | "O" RING, valve housing elbow (6) |
| | 368 269 R1 | "O" RING, valve housing connector (6) |
| | 683 086 C1 | "O" RING |
| | 606 120 C1 | SEAL RING, lube oil pipe (2) |
| | 115 308 | WASHER, thermostat by-pass pipe (11 x 32 x 11/16" x No. 16 ga.) |
| | 306 420 R1 | WASHER, fuel filter element retainer (2) |
| | 306 420 R1 | WASHER, lubricating oil filter case retainer bolt (3) |

**ENGINE VARIATIONS**

**(330, 340, H-100C, D-120C, TD-25C)**

| | | |
|---|---|---|
| 27 | 673 104 C91 | PAN, crankcase oil (Front sump) (Composed of - |
| | | 3 GASKET 59 658 D |
| | | § 1 PAN |
| | | 3 PLUG 445 096 |
| | | 1 PLUG 9 409 949 |
| | | 1 TAG 1 014 858 R1 |
| | 70 428 R1 | SCREW, hex-hd cap (8) |
| | 24 850 R1 | SCREW, hex-hd cap (36) |
| | 26 272 R1 | WASHER, hardened (44) |

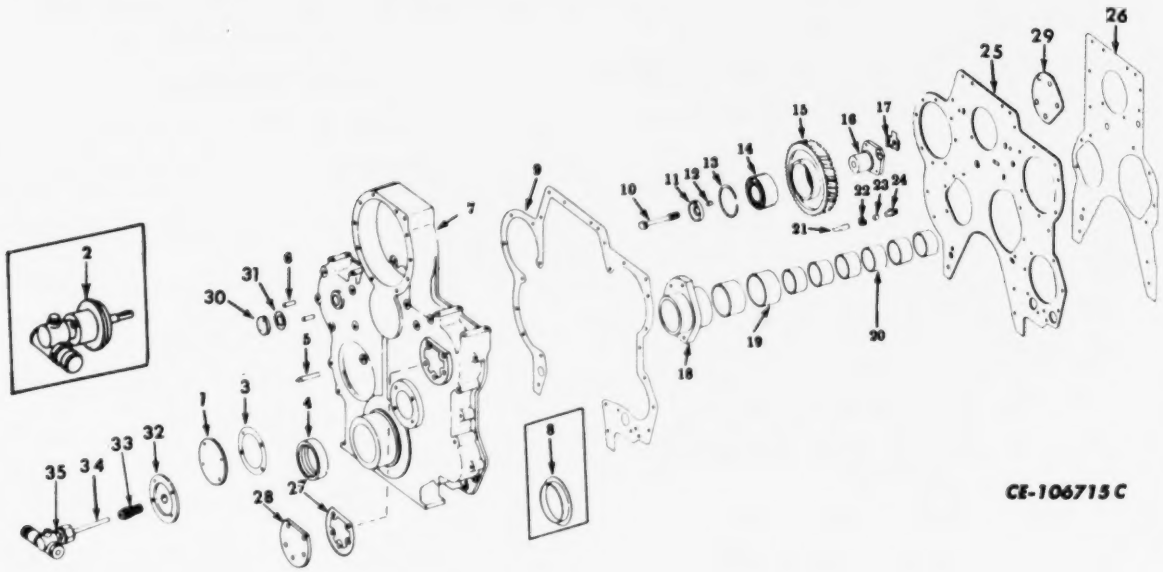
**(H-560)**

| | | |
|---|---|---|
| 27 | 673 104 C91 | PAN, crankcase oil (Front sump) 11674 and below (Composed of - |
| | | 3 GASKET 59 658 D |
| | | § 1 PAN |
| | | 3 PLUG 445 096 |
| | | 1 PLUG 9 409 949 |
| | | 1 TAG 1 014 858 R1) |
| 27 | 681 756 C91 | PAN, crankcase oil (Front sump) 11675 and up (Composed of - |
| | | 3 GASKET 59 658 D |
| | | § 1 PAN |
| | | 3 PLUG 445 096 |
| | | 1 PLUG 9 409 949 |
| | | 1 TAG 1 014 858 R1) |
| | 70 428 R1 | SCREW, hex-hd cap (+) (8) |
| | 24 850 R1 | SCREW, hex-hd cap (+) (36) |
| | 26 272 R1 | WASHER, hardened (44) |

§ – Not Furnished Separately.

(+) – For PAN, 673 104 C91, order ten SCREW, 70 428 R1 and thirty-four SCREW, 24 850 R1.

CRANKCASE FRONT COVER, PLATE, IDLER GEAR AND RELATED PARTS




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | (See Individual Engine Variation) |
| 2 | | (See Individual Engine Variation) |
| 3 | 278 977 R1 | GASKET, tachometer opening cover plate |
| 4 | | OIL SEAL, crankshaft front (Order PACKAGE, 683 398 C1) |
| 5 | 316 079 R1 | POINTER, timing |
| 6 | 681 221 C1 | STUD, fan housing mounting (2) |
| 7 | 678 095 C91 | COVER, crankcase front (Composed of - § 1 COVER; 1 GASKET 620 945 C1; 1 PLATE 672 418 C1; 1 POINTER 316 079 R1; 2 STUD 681 221 C1) |
| | 25 496 R1 | SCREW, hex-hd cap (4) |
| | 24 844 R1 | SCREW, 3/8" hex-hd cap |
| | 24 867 R1 | SCREW, 1/2" hex-hd cap (4) |
| | 423 356 | SCREW w/lock WASHER, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (5) |
| | 26 273 R1 | WASHER, hardened (4) |
| 8 | 250 908 R1 | DEFLECTOR, crankshaft front oil seal oil (No longer available, not required) |
| 9 | 277 816 R1 | GASKET, crankshaft front cover |
| 10 | 375 624 R1 | BOLT, fan idler gear shaft (Type 8) |
| | 277 795 R1 | LOCK, bolt |
| 11 | 278 773 R11 | RETAINER w/PIN, 141 153 fan idler gear bearing |
| 12 | 141 153 | PIN, dowel (Fan idler gear bearing retainer pin) |
| 13 | 252 862 R1 | RING, fan idler gear snap |
| 14 | 610 300 C91 | BEARING, fan idler gear |
| 15 | 278 767 R2 | GEAR, fan idler |
| 16 | 278 770 R1 | SHAFT, fan idler gear |
| | 525 841 R1 | SCREW, hex-hd cap (Type 8) |
| 17 | 277 795 R1 | LOCK, bolt |
| 18 | 277 786 R11 | HUB w/two BEARING, 277 787 R1, camshaft thrust bearing |
| | 140 483 H | SCREW, hex-hd cap (5) |
| | 277 788 R1 | LOCK, bolt (5) |
| 19 | 277 787 R1 | BEARING, camshaft thrust (2) |

§ - Not Furnished Separately.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CRANKCASE FRONT COVER, PLATE, IDLER GEAR AND RELATED PARTS – Continued** |
| 20 | 277 785 R1 | BEARING, camshaft (6) |
| 21 | 277 950 R1 | JET, gear oil |
| 22 | 278 041 R1 | NUT, gear oil jet tube (2) |
| 23 | 278 040 R2 | SLEEVE, gear oil jet tube (2) |
| 24 | 278 039 R1 | CONNECTOR, gear oil jet tube (2) |
| 25 | 277 251 R11 | PLATE, w/four STUD, 256 333 R1, crankcase front |
| | 25 496 R1 | SCREW, hex-hd cap (12) |
| | 50 408 D | LOCK, bolt (12) |
| 26 | 277 806 R1 | GASKET, crankcase front plate |
| 27 | 278 270 R2 | GASKET, injection pump timing cover |
| 28 | 278 269 R1 | COVER, injection pump timing |
| | 26 306 R1 | SCREW, hex-hd cap (5) |
| | 27 326 R1 | WASHER, hardened (5) |
| 29 | | (See Individual Engine Variation) |
| 30 | 672 418 C1 | PLATE, cover |
| | 22 238 R1 | SCREW, hex-hd cap (2) |
| | 103 319 | WASHER, lock (2) |
| 31 | 620 945 C1 | GASKET, cover plate |
| 32 | | (See Individual Engine Variation) |
| 33 | | (See Individual Engine Variation) |
| 34 | | (See Individual Engine Variation) |
| 35 | | (See Individual Engine Variation) |
| | 683 398 C1 | PACKAGE, crankshaft front oil seal service (Consists of SEAL and SLEEVE) |
| | 256 333 R1 | STUD, injection pump adapter housing mounting (2) |
| | 256 333 R1 | STUD, oil and water pump mounting (2) |

**ENGINE VARIATIONS**

**(TD-25C)**

| | | |
|---|---|---|
| 1 | 305 208 R1 | PLATE, camshaft cover |
| | 25 228 R1 | SCREW, hex-hd cap (4) |
| | 27 326 R1 | WASHER, hardened (4) |
| 2 | | RECORDER Service (+) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **(H-100C, D-120C and H-560)** |
| 2 | 619 605 C91 | RECORDER service 13090 and below |
| | 670 585 C1 | SCREW, hex-hd cap (4) |
| | 115 308 | WASHER, hardened (4) |
| | 279 673 R91 | SEAL, wire |
| | | (Order the following parts– |
| | | (+) 1 HOURMETER 709 145 C1 |
| | | (+) 1 VIBRATION DAMPER 116 457 H1 |
| | | (+) 1 SWITCH 663 392 C1 |
| | | (+) 1 BUSHING 444 024 |
| | | (+) 1 TEE 444 256 |
| | | (+) 1 TEE 444 253 |
| | | (+) 1 CABLE 663 187 C1 |
| | | (+) 1 CABLE 709 158 C1 |
| | | (+) 1 CABLE 709 159 C1 |
| | | (+) 1 TERMINAL PACKAGE 709 160 C1 |
| | | (+) 12 STRAP 702 093 C1 |
| | | 1 WIRING SCHEMATIC CZG-2518 |
| | | 1 INSTRUC-TION CZG-2516 |
| | | (+) 1 BRACKET 709 157 C1 |
| | | (+) 2 SCREW 25 483 R1 |
| | | (+) 2 WASHER 115 109 |
| | | (+) 2 NUT 25 519 R1 |
| | | 1 COVER 672 418 C1 |
| | | 1 GASKET 620 945 C1 |
| | | 2 SCREW 26 674 R1 |
| | | 2 WASHER 115 109 ) |
| 29 | 303 834 R1 | PLATE, hydraulic pump hole cover |
| | 20 127 R1 | SCREW, hex-hd cap (3) |
| | 20 835 R1 | NUT, hex (5) |
| | 103 323 | WASHER, lock (3) |
| 32 | 278 975 R11 | BRACKET w/ADAPTER, 318 237 R 21, tachometer drive (Used w/ HOURMETER) |
| | 454 862 | SCREW, hex-hd cap (4) |
| | 115 308 | WASHER, flat (4) |
| 33 | 318 237 R21 | ADAPTER w/NUT, 19 263 R1, tachometer drive (Used w/HOUR-METER) |
| | 19 263 R1 | NUT, esna stop |
| 34 | 347 773 R1 | TIP, adapter (Used w/HOURMETER) |
| 35 | 336 628 R91 | DRIVE w/TIP, 347 773 R1, tachometer angle (Used w/HOUR-METER) |

(+) – Refer to Chassis Parts Catalog.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CRANKCASE FRONT COVER PLATE, IDLER GEAR AND RELATED PARTS – Continued** |
| | | **(330 and 340)** |
| 2 | | RECORDER, service (+) |
| 32 | 278 975 R11 | BRACKET, w/ADAPTER, 318 237 R21 |
| | 115 308 | SCREW, hex-hd cap (4) |
| 33 | 318 237 R21 | ADAPTER w/NUT, 19 263 R1, tachometer drive |
| | 19 263 R1 | NUT, NF Esna stop |
| 34 | 347 773 R1 | TIP, adapter |
| 35 | 336 628 R91 | DRIVE w/TIP, 347 773 R1, tachometer angle |

(+) – Refer to Chassis Parts Catalog.



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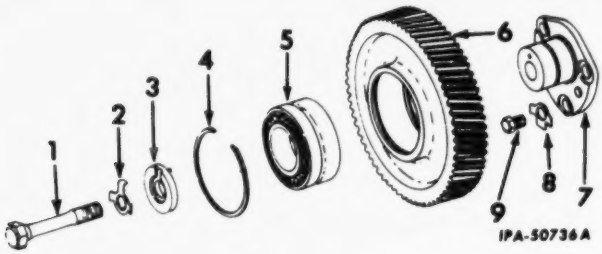
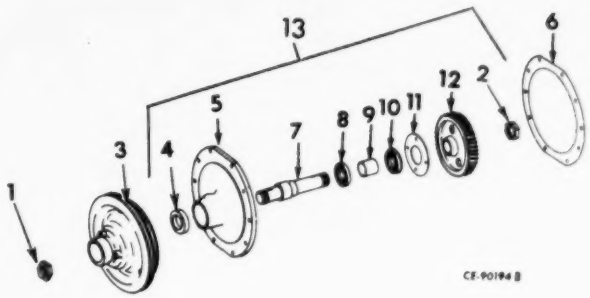
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## HYDRAULIC PUMP IDLER GEAR AND RELATED PARTS
(TD-25C, H-100C, D-120C, 330 and 340) - 10001 and up
(For H-560) - 10615 and below




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 19 767 R1 | BOLT, shaft |
| 2 | 278 800 R1 | LOCK, bolt |
| 3 | 278 772 R11 | RETAINER w/PIN, 141 153, idler gear bearing |
| | 141 153 | PIN, dowel |
| 4 | 41 659 D | RING, idler gear bearing snap |
| 5 | 615 769 C91 | BEARING, idler gear |
| 6 | 278 801 R2 | GEAR, hydraulic pump idler (64-T) |
| 7 | 277 798 R2 | SHAFT, idler gear |
| 8 | 278 771 R1 | LOCK, bolt (3) |
| 9 | 278 790 R1 | SCREW, hex-hd cap (3) |

## AIR COMPRESSOR AND ALTERNATOR DRIVE AND RELATED PARTS
(330 and 340)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 625 345 C1 | NUT, jam |
| 2 | 26 577 R1 | NUT, jam |
| 3 | 670 622 C2 | PULLEY, air compressor and alternator belt drive |
| 4 | 324 732 R91 | OIL SEAL, drive housing |
| 5 | 279 699 R2 | HOUSING |
| 6 | 279 700 R1 | GASKET, housing |
| 7 | 680 582 C1 | SHAFT, drive |
| 8 | 683 166 C91 | BEARING, front |
| 9 | 279 703 R3 | SPACER |
| 10 | 681 626 C91 | BEARING, rear |
| 11 | 310 123 R2 | RETAINER, bearing |
| | 277 788 R1 | LOCK, bolt (4) |
| | 24 839 R1 | SCREW, hex-hd cap (4) |
| 12 | 316 215 R3 | GEAR, drive (54-T) |
| 13 | 318 110 R94 | DRIVE ASSEMBLY, accessory |
| | 25 523 R1 | NUT (2) |
| | 140 483 H | SCREW, hex-hd cap (6) |
| | 25 786 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (10) |

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

# CRANKSHAFT 7

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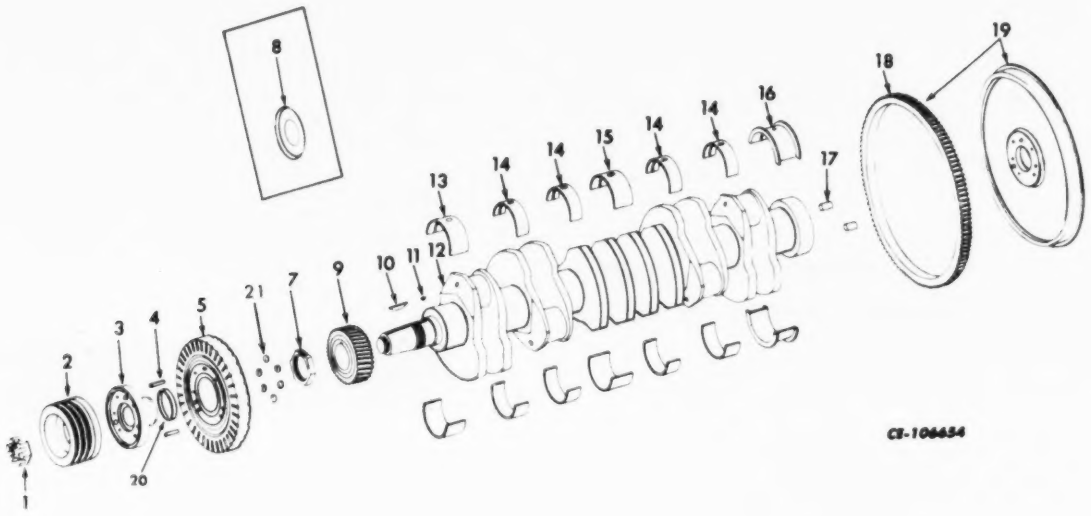
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## CRANKSHAFT VIBRATION DAMPER, FLYWHEEL AND RELATED PARTS




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 612 039 C2 | NUT, crankshaft |
| 2 | | (See Individual Engine Variation) |
| 3 | | (See Individual Engine Variation) |
| 4 | 377 935 R1 | PIN, 1/2 x 1-1/2" dowel (Hardened) (2) |
| 5 | 346 642 R92 | DAMPER, vibration |
| 7 | 625 359 C1 | NUT, crankshaft gear |
| 8 | 250 749 R2 | FLINGER, crankshaft front oil seal oil (No longer available, not required) |
| 9 | 278 765 R2 | GEAR, crankshaft (40-T) |
| 10 | 670 781 C1 | KEY (Woodruff) (Replaces 12 484 R1) (Vibration damper hub) |
| 11 | 688 751 C1 | KEY (Woodruff) (Replaces 117 994) (Crankshaft gear) |
| 12 | 674 969 C92 | CRANKSHAFT ASSY. (Composed of - 1 BEARING 277 618 R91; 4 BEARING 277 621 R91; 1 BEARING 277 624 R91; 1 BEARING 277 627 R91; 6 BEARING 277 144 R91; § 1 CRANKSHAFT; 2 PIN 250 868 R1; 6 PLUG 50 410 DA; 1 TAG, caution 1 019 155 R1) |
| 13 | 277 618 R91 | BEARING, upper and lower front crankshaft (Standard) |
| 13 | 278 399 R91 | BEARING, upper and lower front crankshaft (.030" Undersize) |
| 13 | 320 019 R91 | BEARING, upper and lower front crankshaft (.010" Undersize) |
| 14 | 277 621 R91 | BEARING, upper and lower intermediate crankshaft (Standard) (4) |
| 14 | 320 025 R91 | BEARING, upper and lower intermediate crankshaft (.010" Undersize) (4) |

§ - Not Furnished Separately.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CRANKSHAFT VIBRATION DAMPER, FLYWHEEL AND RELATED PARTS - Continued** |
| 14 | 278 417 R91 | BEARING, upper and lower intermediate crankshaft (.030" Under size) (4) |
| 15 | 277 624 R91 | BEARING, upper and lower center crankshaft (Standard) |
| 15 | 320 031 R91 | BEARING, upper and lower center crankshaft (.010" Undersize) |
| 15 | 278 432 R91 | BEARING, upper and lower center crankshaft (.030" Undersize) |
| 16 | 277 627 R91 | BEARING, upper and lower rear crankshaft thrust (Standard) |
| 16 | 320 037 R91 | BEARING, upper and lower rear crankshaft thrust (.010" undersize) |
| 16 | 278 447 R91 | BEARING, upper and lower rear crankshaft thrust (.030" undersize) |
| 17 | 250 868 R1 | PIN, flywheel dowel (2) |
| 18 | | (See Individual Engine Variation) |
| 19 | | (See Individual Engine Variation) |
| | 50 410 DA | |
| 20 | 619 775 C1 | SLEEVE, [illegible] oil seal |
| 21 | 670 278 C1 | WASHER (6) |

**ENGINE VARIATIONS**

**(TD-25C (Gear Drive))**

| | | |
|---|---|---|
| 3 | 277 562 R52 | HUB w/two PIN, 377 935 R1 and SLEEVE, 619 775 C1, vibration damper |
| | 25 772 R1 | SCREW, hex-hd cap (6) |
| | 310 091 R1 | GEAR, flywheel ring |
| | 670 180 C21 | FLYWHEEL ASSY. |
| | 25 345 R1 | BOLT (6) |
| | 685 903 C1 | WASHER (6) |

**(TD-25C (Power Shift and Arctic))**

| | | |
|---|---|---|
| 3 | 277 562 R52 | HUB w/two PIN, 377 935 R1 and SLEEVE, 619 775 C1, vibration damper |
| | 25 772 R1 | SCREW, hex-hd cap (6) |
| 18 | 310 091 R1 | GEAR, flywheel ring |
| 19 | 322 897 R11 | FLYWHEEL ASSY. |
| | 27 371 R1 | BOLT (6) |
| | 685 903 C1 | WASHER (6) |
| | 316 216 R11 | GEAR, power take-off w/PLUG, 41162-D and two PIN, 19 968 R1 |
| | 138 313 | SCREW, cap (2) |
| | 41 162 D | PLUG, power take-off gear |
| | 19 968 R1 | PIN, power take-off gear (2) |

**(D-120C, H-100C and H-560)**

| | | |
|---|---|---|
| 3 | 277 562 R52 | HUB w/two PIN, 377 935 R1 and SLEEVE, 619 775 C1, vibration damper |
| | 25 772 R1 | SCREW, hex-hd cap (6) |
| 18 | 278 896 R1 | GEAR, flywheel ring |
| 19 | 601 700 C31 | FLYWHEEL ASSY |
| | 25 854 R1 | BOLT (6) |
| | 685 903 C1 | WASHER (6) |

**(330 and 340)**

| | | |
|---|---|---|
| 2 | 670 563 C2 | PULLEY, fan drive (At hub) |
| 3 | 670 562 C21 | HUB w/two PIN, 377 935 R1, and SLEEVE, 619 775 C1, vibration damper |
| | 24 842 R1 | SCREW, hex-hd cap (6) |
| | 670 278 C1 | WASHER, hardened (6) |
| 18 | 278 896 R1 | GEAR, flywheel ring |
| 19 | 670 564 C11 | FLYWHEEL ASSY. |
| | 25 053 R1 | BOLT (6) |
| | 685 903 C1 | WASHER (6) |

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

## CYLINDER HEAD 8



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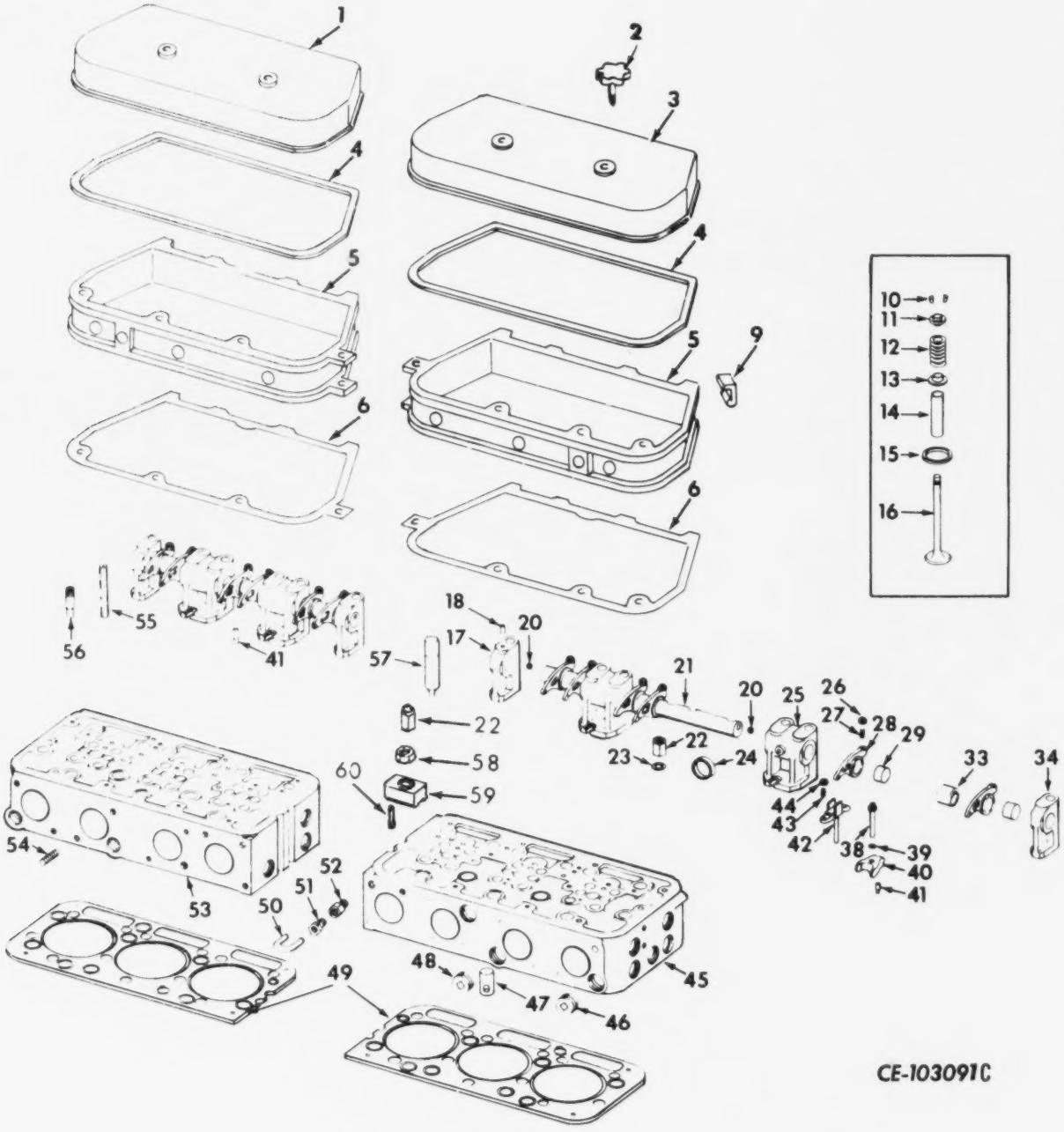
CYLINDER HEAD, VALVE HOUSING, VALVES AND RELATED PARTS



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# CYLINDER HEAD

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CYLINDER HEAD, VALVE HOUSING, VALVES AND RELATED PARTS – Continued** |
| 1 | 671 377 C1 | COVER, rear valve housing |
| 2 | 277 613 R11 | SCREW, valve housing cover (4) |
| | 606 616 C1 | GASKET (4) |
| | 17 271 R1 | PIN, 1/8 x 7/8" roll (4) |
| 3 | 671 377 C1 | COVER, front valve housing |
| 4 | 672 167 C1 | GASKET, valve cover (2) |
| 5 | 671 375 C1 | HOUSING, valve cover (2) |
| | 24 846 R1 | SCREW, hex-hd cap (8) |
| | 140 483 H | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (18) |
| 6 | 671 376 C1 | GASKET, valve housing to cylinder head (2) |
| 9 | 672 662 C2 | CLAMP, valve housing (10) |
| | 374 831 R1 | SCREW, hex-hd cap (10) |
| | 115 093 | WASHER, lock (10) |
| 10 | 60 437 R1 | KEY, valve spring seat (48) |
| 11 | 603 630 C91 | ROTATOR, valve (24) |
| 12 | 607 166 C2 | SPRING, valve (24) |
| 13 | 349 486 R1 | SEAT, lower valve spring (24) |
| 14 | 277 577 R1 | GUIDE, valve (24) |
| 15 | 687 095 C1 | INSERT, exhaust valve seat (.015" oversize)(x) |
| 15 | 687 094 C1 | INSERT, exhaust valve seat (.002" oversize)(x) |
| 15 | 684 456 C1 | INSERT, intake valve seat (.015" oversize)(x) |
| 15 | 684 454 C1 | INSERT, intake valve seat (.002" oversize)(x) |
| 16 | 682 952 C1 | VALVE, intake (12) |
| 16 | 685 278 C1 | VALVE, exhaust (12) |
| 17 | 278 489 R21 | BRACKET w/PIN, 17 145 R1 and PIN, 19 407 R1, rear valve lever (2) |
| 18 | 17 145 R1 | PIN, 3/16 x 3/4" roll (2) |
| 20 | 444 782 | PLUG, 3/8" sq-soc pipe (4) |
| 21 | 328 569 R92 | SHAFT w/three PIN, 142 508, valve lever (2) |
| 22 | 277 605 R1 | NUT, cylinder head stud (25) |
| 23 | 277 606 R1 | WASHER, cylinder head stud nut (24) |
| 24 | 327 413 R1 | PLUG, core hole (6) |
| 25 | 277 593 R21 | BRACKET w/PIN, 19 407 R1, intermediate valve lever (4) |
| 26 | 277 598 R1 | LOCKNUT, valve lever adjusting screw (12) |
| 27 | 678 055 C1 | SCREW, valve lever adjusting (12) |
| 28 | 678 056 C91 | LEVER w/BUSHING, 277 596 R1, SCREW, 678 055 C1 and LOCKNUT 277 598 R1, valve (12) |
| 29 | 277 596 R1 | BUSHING, valve lever (12) |
| 33 | 328 572 R2 | SPACER, valve lever (6) |
| 34 | 277 592 R21 | BRACKET w/PIN, 19 407 R1, front valve lever (2) |
| 38 | 319 675 R1 | SCREW, nozzle crab (6) |
| 39 | 277 604 R1 | WASHER, nozzle crab screw (6) |
| 40 | 277 602 R3 | CRAB, nozzle (6) |
| 41 | 670 200 C1 | SUPPORT, nozzle crab end (6) |
| 42 | 277 590 R1 | BRIDGE, valve lever (12) |
| 43 | 277 591 R1 | SCREW, valve lever bridge (12) |
| 44 | 133 093 R1 | NUT, valve lever bridge screw (12) |
| 45 | 682 924 C91 | HEAD ASSEMBLY, front cylinder (Composed of- |
| | | § 4 BALL |
| | | 2 DIRECTOR 341 277 R1 |
| | | 6 GUIDE 332 109 R11 |
| | | 12 GUIDE 277 577 R1 |
| | | § 1 HEAD |
| | | §12 INSERT |
| | | 1 PLUG 445 751 |
| | | 2 PLUG 444 660 |
| | | 4 PLUG 50 410 DA |
| | | 4 PLUG 9 409 949 |
| | | 3 PLUG 327 413 R1 |
| | | 11 PLUG 304 381 R1 |
| | | 2 POST 277 582 R1 |
| | | 3 SLEEVE 670 199 C1 |
| | | 3 SUPPORT 670 200 C1 |
| | | 6 STUD 674 263 C1 ) |
| 46 | 304 381 R1 | PLUG, 1" sq-soc pipe (22) |
| 47 | 341 277 R1 | DIRECTOR, cylinder head water vent plug (4) |
| 48 | 9 409 949 | PLUG, 3/4" sq-soc pipe (8) |
| 49 | 676 451 C1 | GASKET, cylinder head (2) |
| 50 | 277 583 R2 | TUBE, water transfer |
| 51 | 19 986 R1 | NUT, water transfer tube connector (2) |

(x) – As Required.
§ – Not Furnished Separately.

# CYLINDER HEAD

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **CYLINDER HEAD, VALVE HOUSING, VALVES AND RELATED PARTS – Continued** |
| 52 | 38 026 DM | CONNECTOR, water transfer tube (2) |
| 53 | 682 926 C91 | HEAD ASSEMBLY, rear cylinder (Composed of - |
| | | § 4 BALL |
| | | 2 DIRECTOR 341 277 R1 |
| | | 6 GUIDE 332 109 R11 |
| | | 12 GUIDE 277 577 R1 |
| | | § 1 HEAD |
| | | §12 INSERT |
| | | 6 PLUG 445 751 |
| | | 2 PLUG 444 660 |
| | | 4 PLUG 50 410 DA |
| | | 4 PLUG 9 409 949 |
| | | 3 PLUG 327 413 R1 |
| | | 11 PLUG 304 381 R1 |
| | | 2 POST 277 582 R1 |
| | | 3 SLEEVE 670 199 C1 |
| | | 3 SUPPORT 670 200 C1 |
| | | 6 STUD 674 263 C1 ) |
| 54 | 674 263 C1 | STUD, intake and exhaust manifold (12) |
| 55 | 277 582 R1 | POST, valve housing cover (4) |
| 56 | 332 109 R11 | GUIDE, valve bridge (12) |
| 57 | 670 199 C1 | SLEEVE, nozzle (6) |
| 58 | 671 372 C1 | WASHER, center stud nut 13063 and Below |
| 58 | 687 589 C1 | WASHER, center stud crab 13064 and Up |
| 59 | 687 595 C91 | CRAB ASSY., cylinder head center stud 13064 and Up |
| 60 | 17 283 R1 | PIN, roll 13064 and Up |
| | 701 137 C97 | GASKET SET, cylinder head (Consists of - |
| | 253 660 R1 | GASKET, turbocharger oil inlet tube flange |
| | 253 664 R2 | GASKET, turbocharger oil outlet tube flange |
| | 601 667 C1 | GASKET, valve cover and housing (2) |
| | 277 975 R1 | GASKET, intake manifold center |
| | 277 976 R1 | GASKET, intake manifold end (2) |
| | 279 384 R2 | GASKET, water manifold rear (2) |
| | 303 458 R1 | GASKET, turbocharger air discharge elbow (2) |
| | 303 782 R1 | GASKET, water manifold front (2) |
| | 304 063 R1 | GASKET, exhaust manifold front and rear (2) |
| | 304 064 R1 | GASKET, exhaust manifold intermediate (2) |
| | 676 451 C2 | GASKET, cylinder head (2) |
| | 606 760 C1 | GASKET, valve housing to cylinder head (2) |
| | 276 331 R1 | GASKET, thermostat housing |
| | 316 112 R2 | GASKET, thermostat housing |
| | 601 098 C1 | "O" RING, oil gallery (4) |
| | 310 947 R91 | SEAL, thermostat (2) |
| | 606 616 C1 | GASKET, valve housing cover screw (4) |
| | 670 354 C1 | GASKET, turbocharger |
| | 670 355 C1 | GASKET, oil outlet tube |
| | 618 560 C1 | GASKET, oil inlet tube |
| | 607 200 C1 | GASKET, breather pipe and elbow (2) |
| | 672 167 C1 | GASKET, valve cover (2) |
| | 671 376 C1 | GASKET, valve housing to cylinder head (2) |
| | 673 156 C1 or 678 522 C1 | TUBE of Molykote "G-n" (2.0-oz.) TUBE of Fel-Pro "C-670" (2.0-oz.) |
| | 59 657 D | WASHER, valve housing cover screw (4) ) |
| | 701 097 C1 | KIT, cylinder head gasket insert replacement (Consists of 22 inserts) |
| | 19 407 R1 | PIN, 1/4 x 1/2" roll (8) |
| | 142 508 R1 | PIN, 3/16 x 1-1/4" groove |
| | 50 410 DA | PLUG, 1/8" NPT pipe (10) |
| | 445 751 | PLUG, 1/2" sq-soc pipe (2) |
| | 444 660 | PLUG, 3/8" sq-soc pipe (4) |
| | 671 372 C1 | WASHER, stud |

§ – Not Furnished Separately.



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REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

## ELECTRICAL 9

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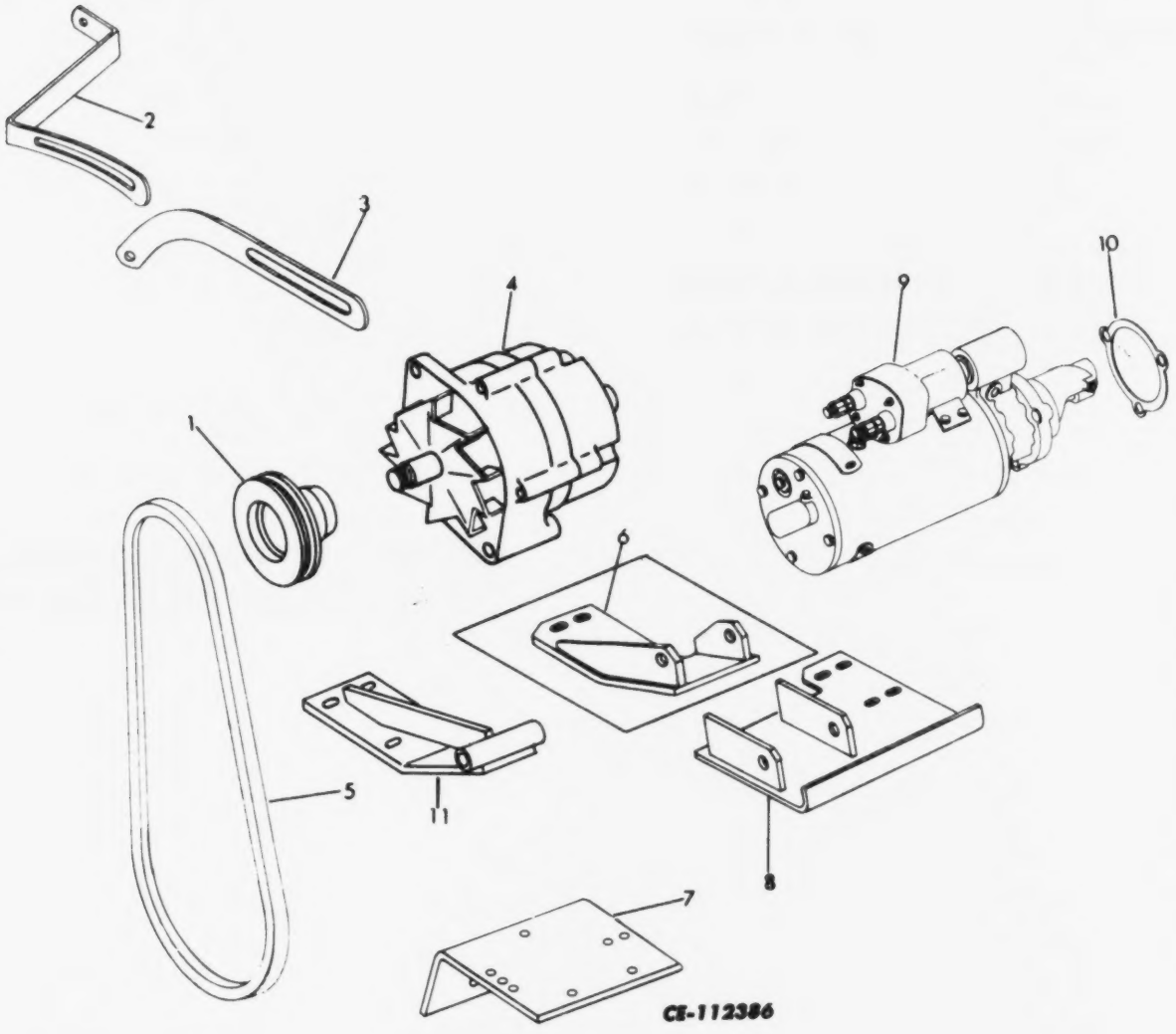
ALTERNATOR AND CONNECTIONS
(TD-25C - 12007 and Below)
(H-100C, D-120C, 330, 340 and H-560 - 10001 and Up)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | (See Individual Engine Variation) |
| 2 | | (See Individual Engine Variation) |
| 3 | | (See Individual Engine Variation) |
| 4 | | ALTERNATOR ASSY. (Refer to "Alternator") |
| | 25 296 R1 | SCREW, hex-hd cap (2) |
| | 24 534 R1 | NUT (2) |
| | 26 273 R1 | WASHER, hardened (2) |
| | 263 717 R91 | CLIP, cable |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **ALTERNATOR AND CONNECTIONS – Continued (For TD-25C - 12007 and Below) (H-100C, D-120C, 330, 340 and H-560 - 10001 and Up)** |
| 5 | | (See Individual Engine Variation) |
| 6 | | (See Individual Engine Variation) |
| 7 | | (See Individual Engine Variation) |
| 8 | | (See Individual Engine Variation) |
| 9 | | MOTOR, cranking (Refer to "Cranking Motor") |
| | 24 874 R1 | SCREW, hex-hd cap (3) |
| | 25 976 R1 | WASHER, lock (3) |
| 10 | 304 573 R1 | GASKET, cranking motor flange |
| 11 | | (See Individual Engine Variation) |
| | | **ENGINE VARIATIONS** |
| | | **(TD-25C)** |
| 1 | 670 463 C1 | PULLEY, Alternator |
| 2 | 670 581 C1 | BRACE, alternator |
| | 324 470 R1 | SCREW, 1-1/8" long hex-hd cap |
| | 20 612 R1 | SCREW, 1-3/8" long hex-hd cap |
| | 103 321 | WASHER, 3/8" lock |
| | 20 324 D | WASHER, flat |
| | 103 232 | WASHER, 1/2" lock |
| 5 | 670 582 C1 | BELT, alternator |
| 8 | 670 580 C1 | BRACKET, alternator |
| | 103 232 | WASHER, lock (4) |
| | 20 612 R1 | SCREW |
| | 263 717 R91 | CLIP, cable |
| | | **(H-100C and D-120C)** |
| 1 | 670 463 C1 | PULLEY, alternator 13744 and Below |
| 1 | 685 847 C1 | PULLEY, alternator 13745 and Up |
| 3 | 670 938 C1 | BRACE, alternator |
| | 24 841 R1 | SCREW, 1-1/2" long hex-hd cap |
| | 24 861 R1 | SCREW, 1-1/4" long hex-hd cap |
| | 25 896 R1 | WASHER, 3/8" flat |
| | 25 710 R1 | WASHER, 1/2" flat |
| | 356 836 R1 | SPACER |
| 5 | 670 939 C2 | BELT, alternator 13744 and Below |
| 5 | 685 509 C1 | BELT, alternator 13745 and Up |
| 6 | 670 461 C2 | BRACKET, alternator 13744 and Below |
| | 24 861 R1 | SCREW, hex-hd cap (4) |
| | 26 273 R1 | WASHER, flat (4) |
| | 263 717 R91 | CLIP, cable |
| 11 | 686 949 C1 | BRACKET, alternator 13745 and Up |
| | 24 862 R1 | SCREW, hex-hd cap (4) |
| | 116 121 | WASHER, lock (4) |
| | 26 273 R1 | WASHER, flat (4) |
| | 263 717 R91 | CLIP, cable |
| | | **(330 and 340)** |
| 1 | 670 463 C1 | PULLEY, alternator 14513 and Below |
| 1 | 685 847 C1 | PULLEY, alternator 14514 and Up |
| 3 | 670 462 C1 | BRACE, alternator 14513 and Below |
| | 24 841 R1 | SCREW, 3/8" hex-hd cap |
| | 24 861 R1 | SCREW, 1/2" hex-hd cap |
| | 356 836 R1 | SPACER |
| | 25 896 R1 | WASHER, 3/8" hardened |
| | 26 273 R1 | WASHER, 1/2" hardened |
| | 200 835 R1 | WASHER, flat |
| 3 | 670 938 C1 | BRACE, alternator 14514 and Up |
| | 25 498 R1 | SCREW, 1-5/8" long hex-hd cap |
| | 24 861 R1 | SCREW, 1-1/4" long hex-hd cap |
| | 25 896 R1 | WASHER, hardened |
| | 26 273 R1 | WASHER, hardened |
| | 314 148 R1 | SPACER |
| | 115 093 | WASHER, 3/8" lock |
| | 116 121 | WASHER, 1/2" lock |
| 5 | 670 464 C1 | BELT, alternator 14513 and Below |
| 5 | 685 509 C1 | BELT, alternator 14514 and Up |
| 6 | 670 461 C2 | BRACKET, alternator 14513 and Below |
| | 25 505 R1 | SCREW, (Type 4)(4) |
| | 26 273 R1 | WASHER, hardened (4) |
| 7 | 670 861 C1 | BRACKET, voltage regulator |
| | 140 483 H | SCREW, hex-hd cap (2) |
| | 25 522 R1 | NUT, hex (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 11 | 686 949 C1 | BRACKET, alternator 14514 and Up |
| | 24 862 R1 | SCREW, hex-hd cap (4) |
| | 116 121 | WASHER, lock (4) |
| | 26 273 R1 | WASHER, flat (4) |
| | 263 717 R91 | CLIP, cable |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | ALTERNATOR AND CONNECTIONS – Continued<br>(For TD-25C - 12007 and Below)<br>(H-100C, D-120C, 330, 340 and H-560 - 10001 and Up) |
| | | (H-560) |
| 1 | 670 463 C1 | PULLEY, alternator |
| 3 | 672 885 C1 | BRACE, alternator |
| | 24 840 R1 | SCREW, 3/8" hex-hd cap |
| | 24 861 R1 | SCREW, 1/2" hex-hd cap |
| | 25 869 R1 | WASHER, 3/8" flat hardened |
| | 25 710 R1 | WASHER, 1/2" flat hardened |
| 5 | 670 464 C1 | BELT, alternator |
| 6 | 670 461 C2 | BRACKET, alternator<br>13462 and Below |
| | 24 861 R1 | SCREW, hex-hd cap (4) |
| | 26 273 R1 | WASHER, flat hardened (4) |
| | 263 717 R91 | CLIP, cable |
| 11 | 686 949 C1 | BRACKET, alternator<br>13463 and Up |
| | 26 317 R1 | SCREW, 1-1/4" long hex-hd cap (4) |
| | 26 273 R1 | WASHER, hardened (4) |
| | 116 121 | WASHER, lock (4) |



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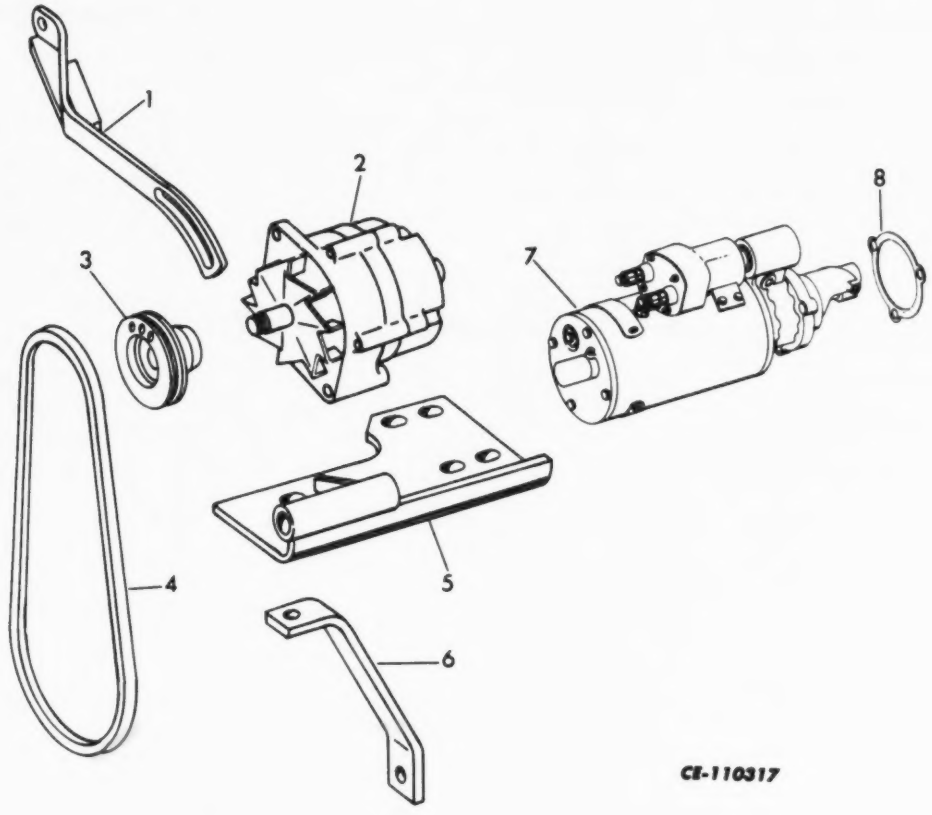
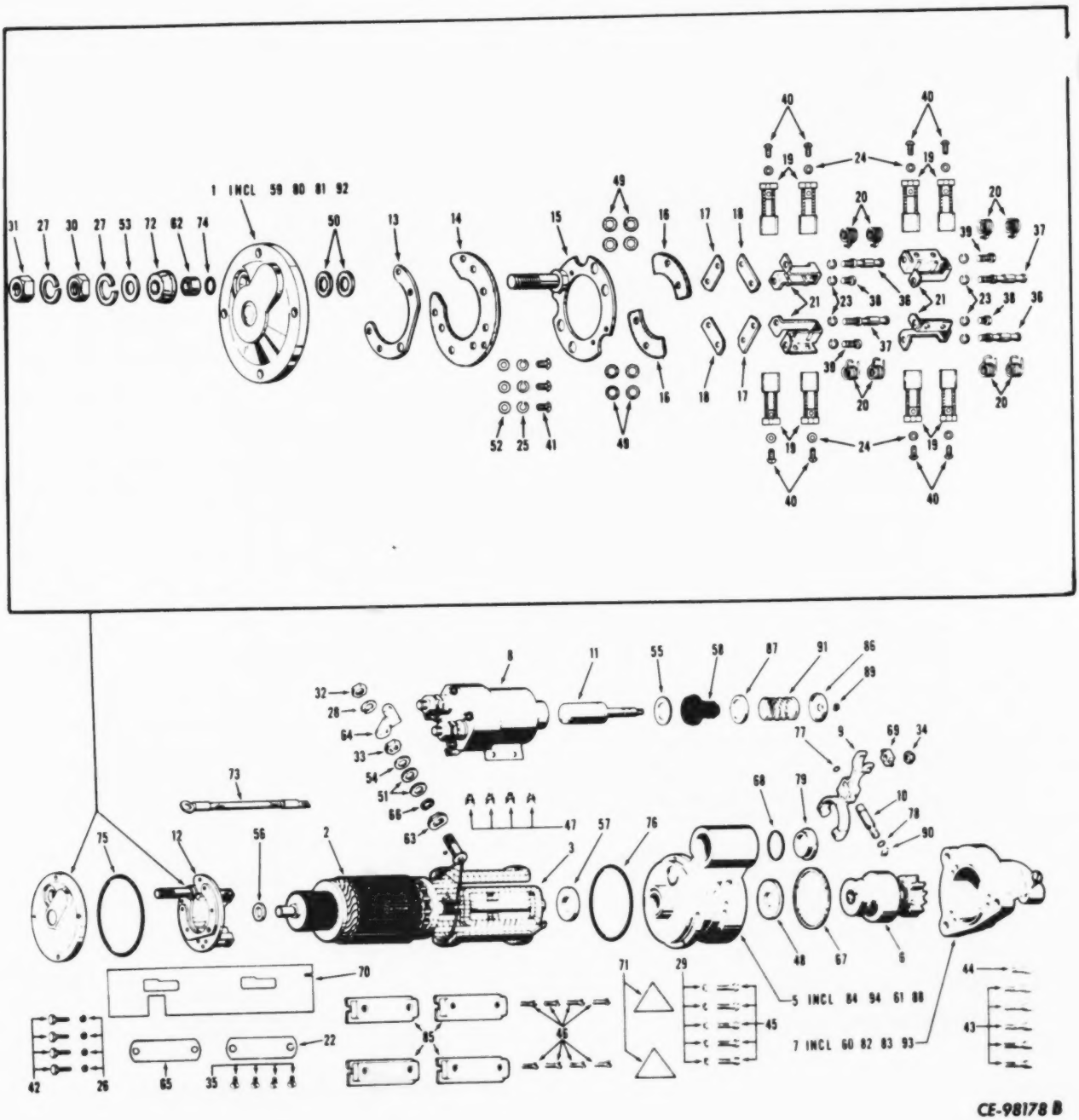
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

## ALTERNATOR AND CONNECTIONS
(TD-25C – 12008 and up)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 686 548 C1 | BRACE, alternator adjusting |
| | 24 862 R1 | SCREW, 1/2" hex-hd cap |
| | 27 347 R1 | SCREW, 3/8" hex-hd cap |
| | 25 896 R1 | WASHER, hardened |
| | 26 273 R1 | WASHER, hardened |
| 2 | | ALTERNATOR ASSY. (Refer to "Alternator") |
| | 25 296 R1 | SCREW, hex-hd cap |
| | 24 534 R1 | NUT, lock |
| | 25 710 R1 | WASHER, hardened (2) |
| | 263 717 R91 | CLIP, cable |
| 3 | 685 847 C1 | PULLEY, alternator |
| 4 | 326 998 R1 | BELT, alternator |
| 5 | 686 551 C2 | BRACKET, alternator |
| | 24 862 R1 | SCREW, hex-hd cap (4) |
| | 26 273 R1 | WASHER, hardened (4) |
| | 116 121 | WASHER, 1/2" lock (4) |
| 6 | 670 467 C1 | GUSSET, alternator bracket |
| | 278 158 R1 | SPACER, gusset |
| | 25 787 R1 | SCREW, 3/8" hex-hd cap |
| | 24 863 R1 | SCREW, 1/2" hex-hd cap |
| | 25 896 R1 | WASHER, hardened |
| | 26 273 R1 | WASHER, hardened (2) |
| | 25 526 R1 | NUT, hex |
| 7 | | MOTOR, cranking (Refer to "Cranking Motor") |
| | 24 874 R1 | SCREW, hex-hd cap (3) |
| | 25 976 R1 | WASHER, lock (3) |
| 8 | 304 573 R1 | GASKET, cranking motor |

**CRANKING MOTOR**
**(Delco-Remy)**




**ILLUSTRATIONS ARE OF TYPICAL PARTS ONLY.**



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **CRANKING MOTOR - Continued** (Delco-Remy) | | |
| | | Parts without letters after the description indicate the part is used for all assemblies listed below. |
| A | 1 113 831 | MOTOR ASSY, cranking (Order MOTOR ASSY, 1 113 905) (For H-100C, D-120C, 330, 340 and 560) |
| B | 1 113 883 | MOTOR ASSY, cranking (For TD-25C) |
| C | 1 113 905 | MOTOR ASSY, cranking (For H-100C, D-120C, 330, 340 and 560) (Will work for MOTOR ASSY, 1 113 831) |
| 1 | 1 951 073 | FRAME ASSY., commutator end (Composed of - 1 BUSHING 38 273; 1 PLUG 453 465; 1 PLUG 103 893; 1 WICK 1 916 439 ) |
| 2 | 1 945 500 | ARMATURE |
| 3 | 1 945 496 | COIL, field (Four coils) |
| 4 | 1 950 561 | STUD, terminal |
| 5 | 1 951 069 | HOUSING, lever (A) |
| 5 | 1 947 262 | HOUSING, lever (B) (Composed of - 1 BUSHING 1 923 484; 1 PLUG 453 465; 1 SEAL 1 918 047; 1 WICK 1 916 439 ) |
| 5 | 801 403 | HOUSING, lever (C) (Composed of - 1 BUSHING 1 923 484; 1 PLUG 1 949 619; 1 SEAL 1 918 047; 1 WICK 1 916 439 ) |
| 6 | | DRIVE ASSY., motor (Refer to "Motor Drive") |
| 7 | 1 945 506 | HOUSING ASSY., drive end (A & B) (Composed of - 1 BUSHING 1 942 258; 1 PLUG 453 465; 1 PLUG 1 961 573; 1 WICK 1 916 439 ) |
| 7 | 1 949 606 | HOUSING ASSY, drive end (C) (Composed of - 1 BUSHING 1 942 258; 1 PLUG 453 465; 1 PLUG 1 961 573; 1 WICK 1 916 439 ) |
| 8 | | SWITCH ASSY., solenoid (Refer to "Solenoid Switch") |
| 9 | 1 945 484 | LEVER, shift |
| 10 | 1 948 529 | LEVER, shaft |
| 11 | 1 948 522 | PLUNGER |
| 12 | 1 948 515 | PLATE, less brushes |
| 13 | 1 874 847 | PLATE, support |
| 14 | 1 909 523 | INSULATOR, brush plate |
| 15 | 1 945 518 | PLATE w/STUD, brush |
| 16 | 1 965 093 | INSULATOR, brush holder (2) |
| 17 | 1 874 848 | PLATE, space insulation holder (2) |
| 18 | 1 874 851 | PLATE, space ground holder (2) |
| 19 | 1 906 986 | BRUSH (A & B) (8) |
| 19 | 1 946 407 | BRUSH (C) (8) |
| 20 | 1 861 785 | SPRING, brush (8) |
| 21 | 1 907 475 | HOLDER, brush (4) |
| 22 | 1 948 513 | PLATE, brush cover (*) (A & C) |
| 22 | 1 945 478 | PLATE, brush cover (*) (B) |
| 23 | 453 435 | LOCK WASHER, brush holder screw (8) |
| 24 | 453 844 | LOCK WASHER, brush lead attaching screw (8) |
| 25 | 453 844 | LOCK WASHER, brush plate assy. (3) |
| 26 | 9 421 423 | LOCK WASHER, commutator end frame attaching screw (4) |
| 27 | 9 421 427 | LOCK WASHER, commutator end terminal stock (2) |
| 28 | 9 421 427 | LOCK WASHER, field terminal stud |
| 29 | 9 421 423 | LOCK WASHER, lever housing attaching screw (5) |
| 30 | 120 238 | NUT, commutator end terminal stud |
| 31 | 120 378 | NUT, commutator end terminal stud |
| 32 | 120 238 | NUT, field terminal stud (A & B) |
| 32 | 9 413 509 | NUT, field terminal stud (C) |
| 33 | 120 238 | NUT, field terminal stud (A & B) |
| 33 | 9 413 509 | NUT, field terminal stud (C) |

(*) For Assemblies w/threaded PLUG, order 1 945 356.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| CRANKING MOTOR - Continued (Delco-Remy) | | |
| 34 | 9 412 305 | NUT, plunger rod guide adjusting |
| 35 | 9 414 397 | SCREW, brush cover plate attaching (4) |
| 36 | 1 928 500 | SCREW, brush holder (Ground brush - long) (2) |
| 37 | 1 904 982 | SCREW, brush holder (Insulator brush - long) (2) |
| 38 | 1 914 580 | SCREW, brush holder (Ground brush - short) (2) |
| 39 | 1 968 656 | SCREW, brush holder (Insulator brush - short) (2) |
| 40 | 453 418 | SCREW, brush lead attaching (8) |
| 41 | 1 847 807 | SCREW, brush plate attaching (3) |
| 42 | 1 914 869 | SCREW, commutator frame attaching (4) |
| 43 | 1 948 536 | SCREW, drive end attaching (5) |
| 44 | 1 948 537 | SCREW, drive end attaching (Short) |
| 45 | 1 914 869 | SCREW, lever housing attaching (5) |
| 46 | 1 968 396 | SCREW, pole shoe (8) |
| 47 | 1 930 611 | SCREW w/lock WASHER, switch attaching (4) |
| 48 | 1 911 644 | WASHER, brake between lever housing and drive housing |
| 49 | 1 913 080 | WASHER, brush holder screw (Insulator - bushing) (8) |
| 50 | 1 861 791 | WASHER, commutator end terminal stud insulator (2) |
| 51 | 1 922 457 | WASHER, field terminal stud insulator (2) |
| 52 | 1 913 086 | WASHER, brush plate attaching screw (Plain) (3) |
| 53 | 1 914 647 | WASHER, commutator end stud (Plain) |
| 54 | 1 914 647 | WASHER, field terminal stud |
| 55 | 807 736 | WASHER, shaft lever return spring retainer (A) |
| 55 | 1 948 519 | WASHER, shaft lever return spring retainer (B & C) |
| 56 | 1 914 842 | WASHER, space commutator end (A) |
| 56 | 1 905 014 | WASHER, space commutator end (B & C) |
| 57 | 1 936 466 | WASHER, space - between armature end lever housing |
| 58 | 801 077 | BOOT, plunger |
| 59 | 38 273 | BUSHING, commutator end frame |
| 60 | 1 945 509 | BUSHING, drive housing (A) |
| 60 | 1 942 258 | BUSHING, drive housing (B & C) |
| 61 | 1 923 484 | BUSHING, lever housing |
| 62 | | BUSHING, insulator commutator end terminal stud (Order PACKAGE, 1 851 632) |
| 63 | | BUSHING, insulator field terminal stud (Order PACKAGE, 1 965 472) |
| 64 | 1 945 468 | CONNECTOR, terminal to switch |
| 65 | 1 948 512 | GASKET, brush cover plate (A & C) |
| 65 | 1 945 477 | GASKET, brush cover plate (B) |
| 66 | | GASKET, insulator field terminal stud (Order PACKAGE, 1 965 472) |
| 67 | 1 945 476 | GASKET, between lever and drive housing (A & B) |
| 67 | 1 948 538 | GASKET, between lever and drive housing (C) |
| 68 | 1 964 857 | GASKET, lever housing plug |
| 70 | 1 945 479 | INSULATOR, field coil (Commutator end) |
| 71 | 1 914 873 | INSULATOR, field coil (Drive end) (2) |
| 72 | | INSULATOR, terminal stud (Commutator end) (Order PACKAGE, 1 851 632) |
| 73 | 1 953 236 | LEAD w/TERMINALS, commutator end terminal to switch |
| 74 | | "O" RING, commutator end terminal stud (Order PACKAGE, 1 851 632) (A & B) |
| 75 | 1 916 272 | "O" RING, field frame seal (Drive end) |
| 76 | 1 916 272 | "O" RING, field frame seal (Commutator end) (A & B) |
| 77 | 1 921 805 | "O" RING, shaft lever (1/2" diameter) |
| 78 | 1 914 373 | "O" RING, shift lever (15/16" diameter) |
| 79 | 1 945 356 | PLUG, lever housing |
| 80 | 103 893 | PLUG, expansion (Commutator end) (A & C) |



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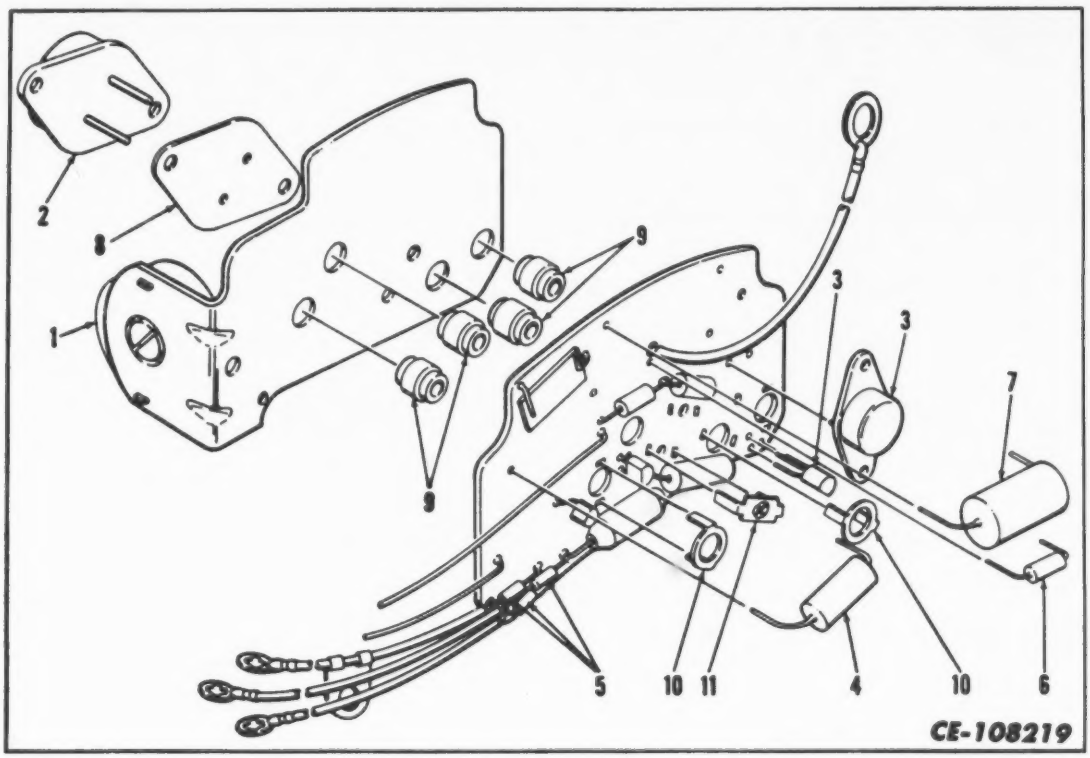
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **CRANKING MOTOR - Continued** (Delco-Remy) | | |
| 81 | 9 427 882 | PLUG, pipe (Commutator end) (A) |
| 81 | 453 465 | PLUG, pipe (Commutator end) (B & C) |
| 82 | 9 427 882 | PLUG, pipe (Drive end housing) (A) |
| 82 | 453 465 | PLUG, pipe (Drive end housing) (B & C) (11/32" diameter) |
| 83 | 1 961 573 | PLUG, pipe (Drive end housing) (1/4" diameter) |
| 84 | 9 427 882 | PLUG, pipe (Lever housing) (A) |
| 84 | 453 465 | PLUG, pipe (Lever housing) (B & C) |
| 85 | 1 934 477 | POLE SHOE (A) |
| 85 | 1 934 478 | POLE SHOE (B & C) |
| 86 | 1 948 526 | RETAINER, shift lever spring (13/32" hole) |
| 87 | 1 948 520 | RETAINER, shift lever spring (1-13/64" hole) |
| 88 | 1 918 047 | SEAL, oil (Lever housing) |
| 89 | 9 415 235 | RING, snap (Lever shaft retainer) |
| 90 | 9 415 235 | RING, snap (Shift lever return spring) |
| 91 | 1 948 521 | SPRING, shift lever return |
| 92 | 1 916 439 | WICK, oil (Commutator end) |
| 93 | 1 916 439 | WICK, oil (Drive housing) |
| 94 | 1 916 439 | WICK, oil (Lever housing) |
| | 1 955 990 | INSULATOR, field coil (Drive end) (A) |
| | 1 965 472 | PACKAGE, field terminal stud gasket and bushing |
| | 1 851 632 | PACKAGE, insulator terminal |
| | 1 948 513 | PLATE, brush cover (A) |
| | 9 417 501 | PLUG, expansion commutator end reservoir |
| | 1 955 303 | PLUG, felt-oil reservoir (Drive housing) |
| | 1 949 619 | PLUG, nose housing holes (C) |
| | 1 945 697 | SEAL, commutator end frame oil (B) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**REGULATOR**
(Delco-Remy) (50 Amp)
(TD-25C Arctic and H-560 – 10001 and up)
(TD-25C Power Shift and Gear Drive – 12008 and up)




**ILLUSTRATIONS ARE OF TYPICAL PARTS ONLY**

| | | |
|---|---|---|
| | 1 969 110 | REGULATOR ASSY (Part of ALTERNATOR ASSY, 1 117 236) (Consists of the following parts - |
| 1 | 1 852 864 | SWITCH w/RESISTOR, 1 969 120, HEAT SINK and LEADS |
| 2 | 1 969 131 | TRANSISTOR |
| 3 | 1 969 113 | TRANSISTOR |
| 4 | 1 969 120 | RESISTOR |
| 5 | 1 967 813 | DIODE (3) |
| 6 | 1 967 813 | DIODE |
| 7 | 1 970 404 | CAPACITOR |
| 8 | 1 962 715 | INSULATOR |
| 9 | 1 961 552 | BUSHING (4) |
| 10 | 1 962 385 | CLIP, ground (2) |
| 11 | 1 960 635 | CLIP, transistor |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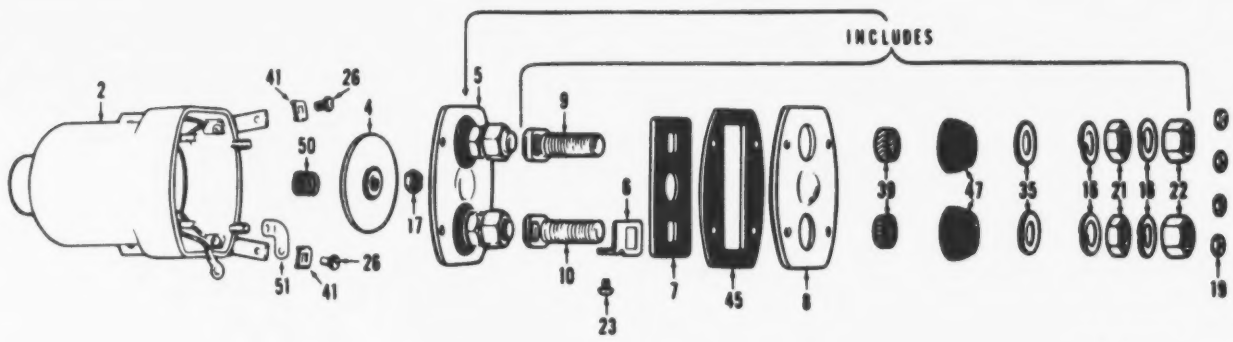
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

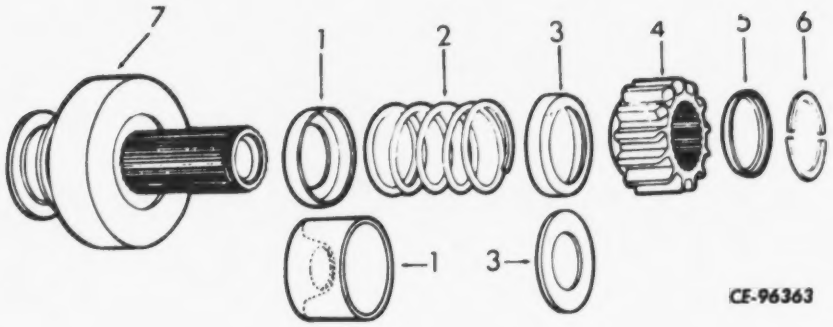
## SOLENOID SWITCH
(Delco-Remy)




**ILLUSTRATIONS ARE OF TYPICAL PARTS ONLY**

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | Parts without letters after the description indicates the part is used for both assemblies listed below. |
| A | 1 115 544 | SWITCH ASSY, solenoid (Part of CRANKING MOTOR ASSY, 1 113 831) (For all models except TD-25C) |
| B | 1 119 848 | SWITCH ASSY, solenoid (Part of CRANKING MOTOR ASSY, 1 113 883 and 1 113 905) (For all models) (Consists of the following parts - |
| 2 | 1 851 222 | CASE and COIL (A) |
| 2 | 1 969 196 | CASE and COIL (B) |
| 4 | 1 954 861 | DISC, contact |
| 5 | 1 876 849 | PLATE, terminal (A) |
| 5 | 1 953 242 | PLATE, terminal (B) |
| 6 | 1 906 051 | SUPPORT, lead (A) |
| 6 | 1 915 716 | SUPPORT, lead (B) |
| 7 | 1 931 673 | INSULATOR |
| 8 | 1 945 409 | PLATE, terminal (A) |
| | 1 971 106 | SCREW, terminal plate attaching |
| 8 | 1 948 659 | PLATE, terminal (B) |
| 9 | 1 891 151 | STUD, bat terminal (A) |
| 9 | 1 953 244 | STUD, bat terminal (B) |
| 10 | 1 891 152 | STUD, motor terminal (A) |
| 10 | 1 906 049 | STUD, motor terminal (B) |
| 16 | 9 421 427 | WASHER, lock terminal stud |
| 17 | | NOT USED |
| 19 | 9 414 418 | NUT, terminal (A) |
| 19 | 1 948 656 | NUT, terminal plate attaching (B) |
| 21 | 9 414 418 | NUT, terminal (B) |
| 22 | 9 413 509 | NUT, terminal |
| 23 | 1 840 633 | SCREW, coil lead attaching (B) |
| 26 | 1 915 717 | SCREW, terminal |
| 35 | 1 914 647 | WASHER, plain terminal |
| 39 | 1 942 969 | BUSHING, terminal stud insulator |
| 41 | 1 915 718 | CLAMP, terminal |
| 45 | 1 950 111 | GASKET, terminal plate |
| 47 | 1 944 836 | INSULATOR, terminal stud (A) |
| 47 | 1 944 841 | INSULATOR, terminal stud (B) |
| 50 | 1 945 402 | SPRING, contact return (A) |
| 50 | 1 948 661 | SPRING, contact return (B) |
| 51 | 1 924 970 | STRAP, ground (B) |

MOTOR DRIVE




ILLUSTRATIONS ARE OF TYPICAL PARTS ONLY

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 800 066 | DRIVE ASSY., motor (Consists of the following parts - |
| 1 | 1 968 229 | CUP, spring retainer |
| 2 | 800 065 | SPRING, meshing |
| 3 | 1 968 225 | CUP, spring retainer |
| 4 | 800 146 | PINION |
| 5 | 1 945 490 | CUP, pinion stop |
| 6 | 801 208 | PACKAGE, split washer |
| 7 | | SHAFT and GEAR motor drive (Not furnished separately) |
| | 812 410 | BUSHING, shaft and gear motor drive |
| | 1 946 842 | SEAL, inner |
| | 1 964 849 | SEAL, outside |
| | 1 971 900 | SPRAG |
| | 1 943 238 | SPRING, garter |



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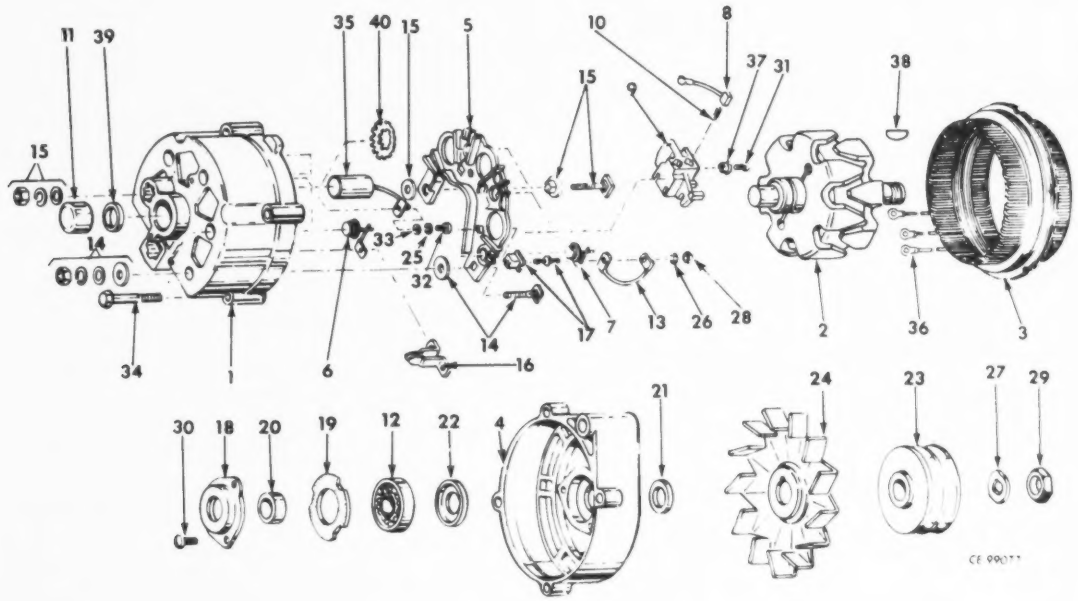
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

ALTERNATOR w/o INTEGRAL REGULATOR
(Delco-Remy)
TD-25C (Power Shift and Gear Drive) - 12007 and Below
H-100C - 13744 and Below
D-120C - 10001 and Up
330 and 340 - 14513 and Below (+)




ILLUSTRATIONS ARE OF TYPICAL PARTS ONLY

| | | |
|---|---|---|
| A | 1 100 061 | ALTERNATOR ASSY. (H-100C PAYloader, D-120C PAYdozer, and 330 and 340 PAYhaulers)(+) |
| B | 1 100 062 | ALTERNATOR ASSY. (TD-25C Crawler Tractor) |
| 1 | 1 971 701 | FRAME ASSY., slip ring end (A) (Composed of - 1 BEARING 7 451 782; § 1 FRAME; 1 DIODE 1 964 354; 1 SEAL 1 961 323; 1 SPRING 1 960 750 ) |
| 1 | 1 971 702 | FRAME ASSY., slip ring end (B) (Composed of - 1 BEARING 7 451 782; 1 DIODE 1 964 354; § 1 FRAME; 1 SEAL 1 961 323; 1 SPRING 1 960 750 ) |
| 2 | 1 971 264 | ROTOR (A) |
| 2 | 1 971 260 | ROTOR (B) |
| 3 | 1 971 220 | STATOR w/three CLIP, 1 959 532 |
| 4 | 1 969 043 | FRAME, drive end (A) |
| 4 | 1 969 066 | FRAME, drive end (B) |
| 5 | 1 971 703 | SINK w/PACKAGE, 1 959 834, DIODE, 1 964 353, WASHER, 9 419 392 and three NUT, 453 434, heat |
| 6 | 1 964 354 | DIODE, negative |
| 7 | 1 964 353 | DIODE, positive |
| 8 | | BRUSH (Order HOLDER, 1 964 682) |
| 9 | 1 964 682 | HOLDER w/BRUSH and SPRING, 1 964 117, brush |
| 10 | 1 964 117 | SPRING, brush |
| 11 | 9 437 171 | BEARING, slip ring end roller |
| 12 | 907 940 | BALL BEARING |
| 13 | | NOT USED |
| 14 | 1 971 704 | PACKAGE, battery terminal |

Always give Alternator Number when ordering parts.
§ – Not Furnished Separately.
(+) – For 330 and 340 equipped w/ALTERNATOR, 1 117 236 refer to Chassis Parts Catalog.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **ALTERNATOR w/o INTEGRAL REGULATOR –Cont. (Delco-Remy)** | | |
| **TD-25C (Power Shift and Gear Drive) - 12007 and Below** | | |
| **H-100C - 13744 and Below** | | |
| **D-120C - 10001 and Up** | | |
| **330 and 340 - 14513 and Below (+)** | | |
| 15 | 1 971 705 | PACKAGE, relay terminal |
| 16 | | NOT USED |
| 17 | 1 959 834 | PACKAGE, diode junction terminal |
| 18 | 1 961 867 | PLATE, ball bearing retainer |
| 19 | 1 955 633 | GASKET, ball bearing retainer plate |
| 20 | 1 970 384 | COLLAR, inside |
| 21 | 1 969 046 | COLLAR, shaft (Outside) |
| 22 | | NOT USED |
| 23 | | NOT USED |
| 24 | 1 969 034 | FAN, alternator (A) |
| 24 | 1 969 069 | FAN, alternator (B) |
| 25 | 9 419 392 | WASHER, capacitor terminal and heat sink attaching screw lock |
| 26 | 9 419 392 | WASHER, diode junction terminal lock |
| 27 | 1 906 406 | WASHER, shaft nut |
| 28 | 453 434 | NUT, diode junction terminal |
| 29 | 9 418 881 | NUT, shaft |
| 30 | 120 222 | SCREW, ball bearing retainer plate attaching |
| 31 | 1 957 501 | SCREEN, brush holder attaching |
| 32 | 1 916 336 | SCREW, capacitor terminal and heat sink attaching |
| 33 | | NOT USED |
| 34 | 1 956 975 | BOLT, thru |
| 35 | 1 959 455 | CAPACITOR |
| 36 | 1 846 548 | CLIP, stator terminal (3) |
| 37 | | NOT USED |
| 38 | | NOT USED |
| 39 | 1 961 323 | SEAL, slip ring end roller bearing |
| 40 | 1 960 750 | RETAINER, capacitor retaining spring |
| | 1 969 073 | CONNECTOR, strap (Relay terminal to diode junction) |
| | 1 969 062 | BUSHING, slip ring end mounting |
| | 1 970 227 | CAP, relay terminal cover (Rubber) |
| | 1 969 055 | DAMPENER, heat sink |
| | 1 969 070 | DUST SHIELD, drive end (B) |
| | 1 959 389 | INSULATOR, capacitor terminal screw and heat sink |
| | 1 969 052 | INSULATOR, capacitor terminal and heat sink attaching screw |
| | 455 160 | PIN, dowel (Slip ring end) |
| | 1 955 664 | PLATE, felt retainer (Drive end) |
| | 1 969 056 | PLUG, slip ring end expansion |
| | 132 900 | SCREW, ground |
| | 1 965 104 | SCREW, ball bearing retainer attaching |
| | 274 937 | SCREW, shroud attaching drive end (B) |
| | 1 969 068 | SHROUD, drive end (B) |
| | 1 970 722 | SEAL, relay terminal |
| | 1 969 042 | SEAL, rotor shaft |
| | 1 970 139 | TUBE, insul. reg. heat sink screw (B) |
| | 1 955 660 | WASHER, felt (Drive end) |
| | 9 419 392 | WASHER, spring brush holder attaching screw |
| | 453 435 | WASHER, ground screw (B) |

Always give ALTERNATOR NUMBER when ordering parts.

(+) – For 330 and 340 equipped w/ALTERNATOR, 1 117 236 refer to Chassis Parts Catalog.



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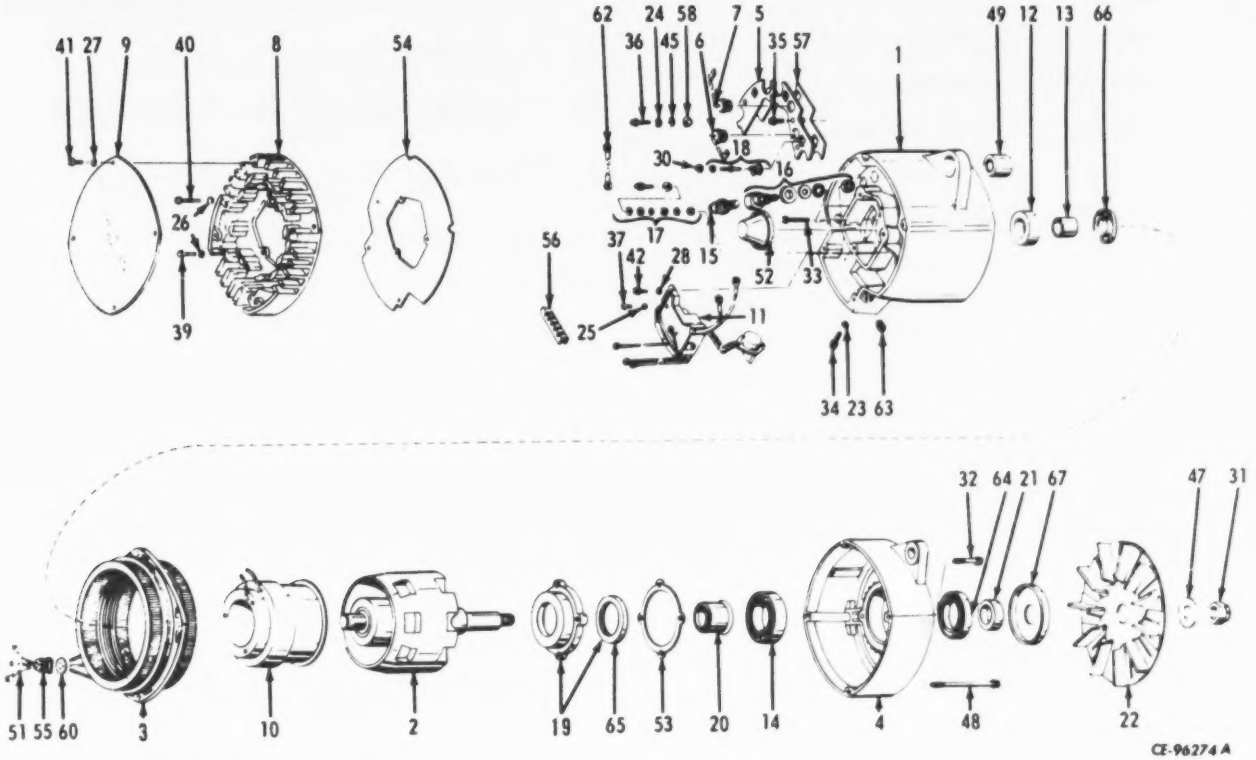
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**ALTERNATOR w/INTEGRAL REGULATOR (High Output)**
(Delco-Remy)
(TD-25C (Arctic) and H-560 – 10001 and up)
(TD-25C (Power Shift and Gear Drive) – 12008 and up)




**ILLUSTRATIONS ARE OF TYPICAL PARTS ONLY**

| | | |
|---|---|---|
| A | 1 117 236 | ALTERNATOR w/REGULATOR ASSY (Order ALTERNATOR w/ REGULATOR ASSY, 1 117 248) |
| B | 1 117 248 | ALTERNATOR w/REGULATOR ASSY (Will work for ALTERNATOR ASSY, 1 117 236) (Optional w/ ALTERNATOR ASSY, 683 728 C91) (Consists of the following parts - |
| 1 | 1 971 653 | FRAME ASSY., rectifier end (A) (Composed of - 1 BEARING 9 436 064; 1 BUSHING 1 968 990; 1 COVER 1 968 913; 1 DIODE 1 971 671; 1 PLUG 9 427 882; 1 SEAL 1 966 554 ) |
| 1 | 1 892 960 | FRAME ASSY, rectifier end (B) (Composed of - 1 BEARING 9 436 064; 1 BUSHING 1 968 990; 1 DIODE 1 971 671; 1 PLUG 1 876 813; 1 PLUG 9 427 882 ) |
| 2 | 1 968 904 | ROTOR ASSY. |
| 3 | 1 971 465 | STATOR ASSY. (Composed of - 1 CLIP 1 969 671; 1 GROMMET 1 968 900; 1 INSULATOR 1 968 901 ) |
| 4 | 1 852 726 | FRAME, drive end |
| 5 | 1 971 670 | HEAT SINK w/DIODE, 1 971 672 and STUD, 1 971 675 |

NOTE: Always give ALTERNATOR NUMBER when ordering parts.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **ALTERNATOR w/INTEGRAL REGULATOR (High Output) - Continued** (Delco-Remy) TD-25C (Arctic) and H-560 – 10001 and up) TD-25C (Power Shift and Gear Drive) – 12008 and up) |
| 6 | 1 971 671 | DIODE, frame end |
| 7 | 1 971 672 | DIODE, heat sink |
| 8 | 1 969 000 | COVER, rectifier end |
| 9 | 1 969 001 | PLATE, rectifier end |
| 10 | 1 969 133 | COIL, field and support |
| 11 | | REGULATOR (Refer to "Regulator") |
| 12 | 7 451 640 | BEARING, rectifier end outer race (1.57" OD) |
| 12 | 9 436 064 | BEARING, rectifier end outer race (1.18" OD) |
| 13 | 7 451 641 | BEARING, rectifier end inner race (0.69" long) |
| 13 | 9 436 063 | BEARING, rectifier end inner race (1.00" long) |
| 14 | 908 055 | BEARING, drive end |
| 15 | 1 969 002 | TERMINAL, output (Male) |
| 16 | 1 971 674 | TERMINAL PACKAGE, output (Female) |
| 17 | 1 971 673 | TERMINAL PACKAGE, relay |
| 18 | 1 971 675 | STUD PACKAGE, diode junction |
| 19 | 1 970 407 | RETAINER PLATE w/SEAL, 1 958 509, drive end |
| 20 | 1 968 885 | COLLAR, drive end (Inside) |
| 21 | 1 968 890 | COLLAR, drive end (Outside) |
| 22 | 1 969 481 | FAN |
| 23 | 9 421 423 | WASHER, lock ground screw |
| 24 | 453 844 | WASHER, lock heat sink attaching |
| 25 | 9 416 003 | WASHER, lock-lead attaching to regulator |
| 26 | 453 435 | WASHER, lock - rectifier cover attaching (2) |
| 27 | 453 844 | WASHER, lock - rectifier cover plate attaching |
| 28 | 453 844 | WASHER, lock - regulator attaching screw |
| | 9 416 005 | WASHER, lock (No. 8 int. tooth) regulator attaching SCREW |
| | 453 474 | WASHER, lock - thru bolt |
| 30 | 453 996<br>271 163 | NUT, regulator lead to diode attaching<br>NUT, regulator terminal stud |
| 31 | 9 418 881 | NUT, rotor shaft drive end |
| 32 | 1 968 994 | SCREW, drive end bearing retainer attaching |
| 33 | 1 968 945 | SCREW, field coil and support attaching |
| 34 | 9 427 129 | SCREW, ground |
| 35 | 1 970 397 | SCREW, ground lead attaching to heat sink |
| 36 | 1 968 940 | SCREW, heat sink attaching |
| 37 | 1 961 570 | SCREW and LOCKWASHER - lead attaching to regulator |
| 39 | 1 846 956 | SCREW, rectifier cover attaching (No. 10 x 3/4") |
| 40 | 1 846 957 | SCREW, rectifier cover attaching (No. 10 x 1-3/8") |
| 41 | 1 846 955 | SCREW, rectifier cover plate attaching |
| 42 | 1 970 397 | SCREW, regulator attaching |
| 45 | 1 930 159 | WASHER, plain heat sink attaching screw (A) |
| 45 | 815 540 | WASHER, plain heat sink attaching screw (B) |
| 47 | 1 905 406 | WASHER, rotor shaft nut - drive end |
| 48 | 1 968 991 | BOLT, thru |
| 49 | 1 968 990 | BUSHING, mounting hinge rectifier housing |
| 51 | 1 969 671 | CLIP, terminal stator leads |
| 52 | 1 968 913 | COVER, bearing weld rectifier housing (A) |
| 52 | 1 876 813 | PLUG, rectifier housing expansion (B) |
| 53 | 1 968 884 | GASKET, bearing retainer drive end |
| 54 | 1 970 395 | GASKET, rectifier end cover |
| 55 | 1 968 900 | GROMMET, stator leads |

NOTE: Always give ALTERNATOR NUMBER when ordering parts.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

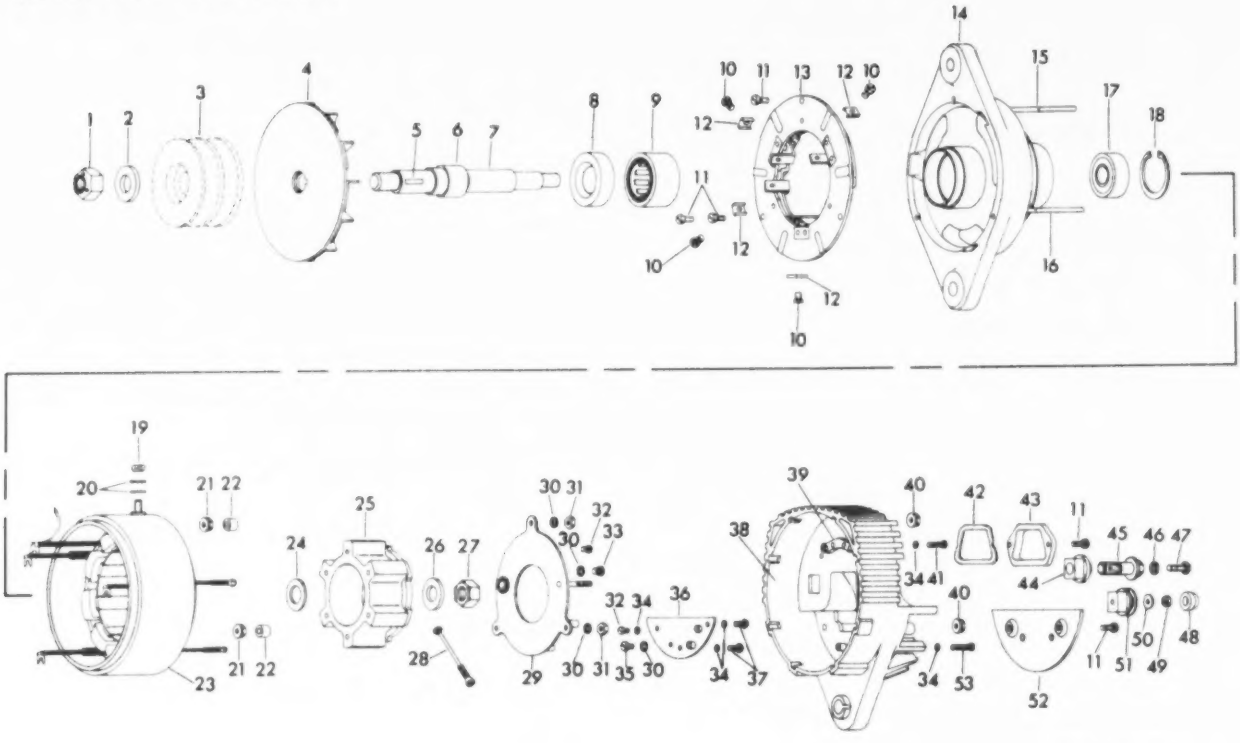
**ALTERNATOR w/INTEGRAL REGULATOR (High Output) - Continued**
(Delco-Remy)
(TD-25C (Arctic) and H-560 – 10001 and up)
(TD-25C (Power Shift and Gear Drive) – 12008 and up)

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 56 | 1 968 996 | GROMMET, five slot |
| 57 | 1 968 930 | INSULATION, between heat sink and rectifier housing |
| 58 | 1 959 389 | INSULATOR, heat sink attaching screw |
| 60 | 1 968 901 | INSULATOR, stator lead grommet |
| 62 | 1 968 988 | LEAD, relay terminal to heat sink (A) |
| 63 | 9 427 882 | PIPE PLUG, voltage adjust |
| 64 | 1 958 509 | SEAL, drive end bearing outside |
| 65 | 1 958 509 | SEAL, drive end bearing retainer |
| 66 | 1 966 554 | SEAL, oil bearing well rectifier housing (A) |
| 67 | 1 968 891 | SLINGER, grease drive end |
| | 1 970 227 | CAP, relay terminal (Rubber) |
| | 271 163 | NUT w/WASHER, regulator terminal stud (A) |
| | 1 851 808 | NUT w/WASHER, regulator terminal stud (B) |
| | 1 971 550 | PULLEY (A) |
| | 1 846 938 | SUPPORT, regulator lead to ground |
| | 1 882 267 | WASHER, plain regulator attaching screw |
| | 453 844 | WASHER, ground lead to heat sink attaching |

NOTE: Always give ALTERNATOR NUMBER when ordering parts.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

ALTERNATOR w/INTEGRAL REGULATOR
(High Output)
(I.H.)
(TD-25C - 12008 and Up)
(H-100C - 13745 and Up)
(330 and 340 - 14514 and Up)(+)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 683 728 C91 | ALTERNATOR (Optional w/ ALTERNATOR, 1 117 248) (+) (Consists of the following parts - |
| 1 | | LOCKNUT, 5/8" NF (*) |
| 2 | | WASHER, .63" ID x 1.37" OD x .109" hardened (*) |
| 3 | 685 847 C1 | PULLEY (Not part of ALTERNATOR, 683 728 C91) |
| 4 | 634 325 C1 | FAN ASSEMBLY |
| 5 | | KEY, Woodruff (Order SHAFT ASSY., 634 332 C91) |
| 6 | | SHAFT (Order SHAFT ASSY., 634 332 C91) |
| 7 | 634 332 C91 | SHAFT ASSEMBLY |
| 8 | | SEAL, bearing (Order SHAFT ASSY., 634 332 C91) |
| 9 | | BEARING, front (Order SHAFT ASSY., 634 332 C91) |
| 10 | | SCREW, No. 10 NF x .25" pan-hd (*) (4) |
| 11 | | SCREW, No. 8 x 3/8" pan-hd (*) (7) |
| 12 | | TERMINAL LOCK (*) (4) |
| 13 | 634 330 C1 | HEAT SINK ASSEMBLY |
| 14 | 634 334 C91 | FORGING and FIELD WINDING ASSEMBLY |

(+) – For 330 and 340 equipped w/ALTERNATOR 1 117 236 or 1 117 248, refer to Chassis Parts Catalog.
(*) – Order PACKAGE, 634 335 C91.

Always give ALTERNATOR NUMBER when ordering parts.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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **ALTERNATOR w/INTEGRAL REGULATOR (High Output) – Continued (I.H.) (TD-25C - 12008 and Up) (H-100C - 13745 and Up) (330 and 340 - 14514 and Up)(+)** | | |
| 15 | | STUD, 4.13" long (*) |
| 16 | | STUD, 4-3/4" long (*) (2) |
| 17 | | BEARING, rear (Order SHAFT ASSY., 634 332 C91) |
| 18 | | RETAINING RING (*) |
| 19 | | LOCKNUT, 1/4" (*) |
| 20 | | WASHER, .260" ID x .56" OD x .040" flat (*) (2) |
| 21 | | NUT, No. 10 NF x .440" OD, flanged hex (*) (3) |
| 22 | | BUSHING, .203" ID x .38" OD x .27" (*) (3) |
| 23 | 634 333 C91 | STATOR and SHELL ASSEMBLY |
| 24 | | WASHER, .673" ID x 1.18" OD x .063", hardened (*) |
| 25 | 634 331 C1 | ROTOR ASSEMBLY |
| 26 | | WASHER, .53" ID x 1.06" OD x .09" hardened (*) |
| 27 | | LOCKNUT, 1/2" NF (*) |
| 28 | 634 329 C1 | GROUND LEAD ASSEMBLY |
| 29 | 634 328 C1 | REGULATOR ASSEMBLY |
| 30 | | WASHER, .209" ID x .365" OD x .015" spring (*) (6) |
| 31 | | NUT, No. 10 double chamfered, hex (*) (3) |
| 32 | | SCREW, No. 6 x 3/16" pan-hd (*) (2) |
| 33 | | SCREW, No. 10 NF x .18" pan-hd (*) (2) |
| 34 | | WASHER, .140" ID x .240" OD x .015" spring (*) (6) |
| 35 | | SCREW, No. 8 x 3/16" binding head (*) |
| 36 | 634 327 C1 | LOAD DUMP ASSEMBLY |
| 37 | | SCREW, No. 6 x .312" round head (*) (3) |
| 38 | 634 326 C91 | END HOUSING ASSEMBLY |
| 39 | | INSULATOR (*) |
| 40 | | LOCKNUT, No. 10 x .465" OD, flanged hex (*) (3) |
| 41 | | SCREW, No. 6 x 1/2" pan-hd (*) |
| 42 | | GASKET (*) |
| 43 | | VOLTAGE ADJUST COVER (*) |
| 44 | | INSULATOR (Red) (*) |
| 45 | | STUD, 7/16 x 1.03", output (*) |
| 46 | | LOCKWASHER, .225" ID x .058", split (*) |
| 47 | | SCREW, No. 12 x 1/2" hex-hd cap (*) |
| 48 | | RUBBER "R" TERMINAL CAP (*) |
| 49 | | LOCKNUT, No. 8NF (*) |
| 50 | | WASHER, .171" ID x .500" OD x .035", flat (*) |
| 51 | | INSULATOR (White)(*) |
| 52 | | PLATE, cover (Order HOUSING ASSY., 634 326 C91) |
| 53 | | SCREW, No. 6 x 5/8" pan-hd (*) |
| | 634 335 C91 | PACKAGE, small parts (Hardware) (Consists of Ref. Nos. 1, 2, 10, 11, 12, 15, 16, 18 thru 22, 24, 26, 27, 30 thru 35, 37, 39 thru 51 and 53) |

(+) – For 330 and 340 equipped w/ALTERNATOR 1 117 236 or 1 117 248, refer to Chassis Parts Catalog.

(*) – Order PACKAGE, 634 335 C91.

Always give ALTERNATOR NUMBER when ordering parts.

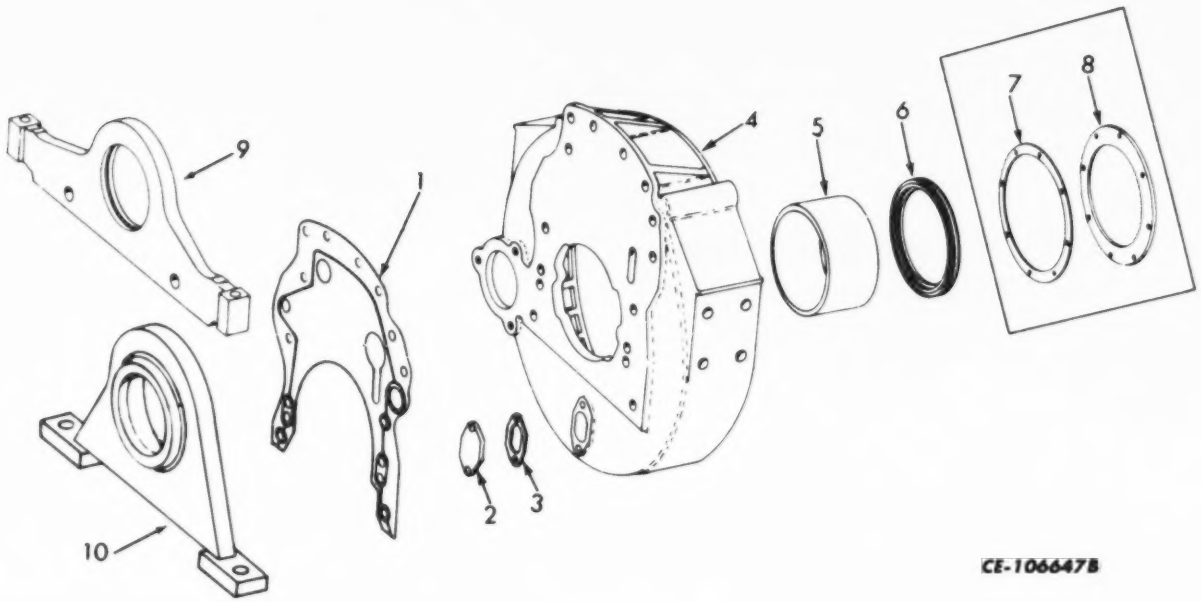
REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

## ENGINE MOUNTING 10

Printed in United States of America.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

FLYWHEEL HOUSING FRONT SUPPORT AND RELATED PARTS
(H-100C, D-120C, 330, 340 and H-560)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 323 815 R2 | GASKET, flywheel housing |
| 2 | 345 461 R2 | PLATE, flywheel housing cover |
| | 25 768 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 3 | 345 462 R1 | GASKET, flywheel housing cover plate |
| 4 | | (See Individual Engine Variation) |
| 5 | | (See Individual Engine Variation) |
| 6 | | (See Individual Engine Variation) |
| 7 | 277 803 R2 | GASKET, crankshaft rear oil seal face plate (Used w/HOUSING, 670 929 (C1) or 349 367 (R1) and PACKAGE, 678 536 C91 (Double lipped) |
| 8 | 349 295 R1 | RETAINER, crankshaft rear oil seal face (Used w/HOUSING, 670 929 (C1) or 349 367 (R1) and PACKAGE, 678 536 C91 (Double lipped) |
| | 26 306 R1 | SCREW, hex-hd cap (8) |
| 9 | | (See Individual Engine Variation) |
| 10 | | (See Individual Engine Variation) |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

**FLYWHEEL HOUSING FRONT SUPPORT AND RELATED PARTS – Continued (H-100C, D-120C, 330, 340 and 560)**

**ENGINE VARIATIONS**

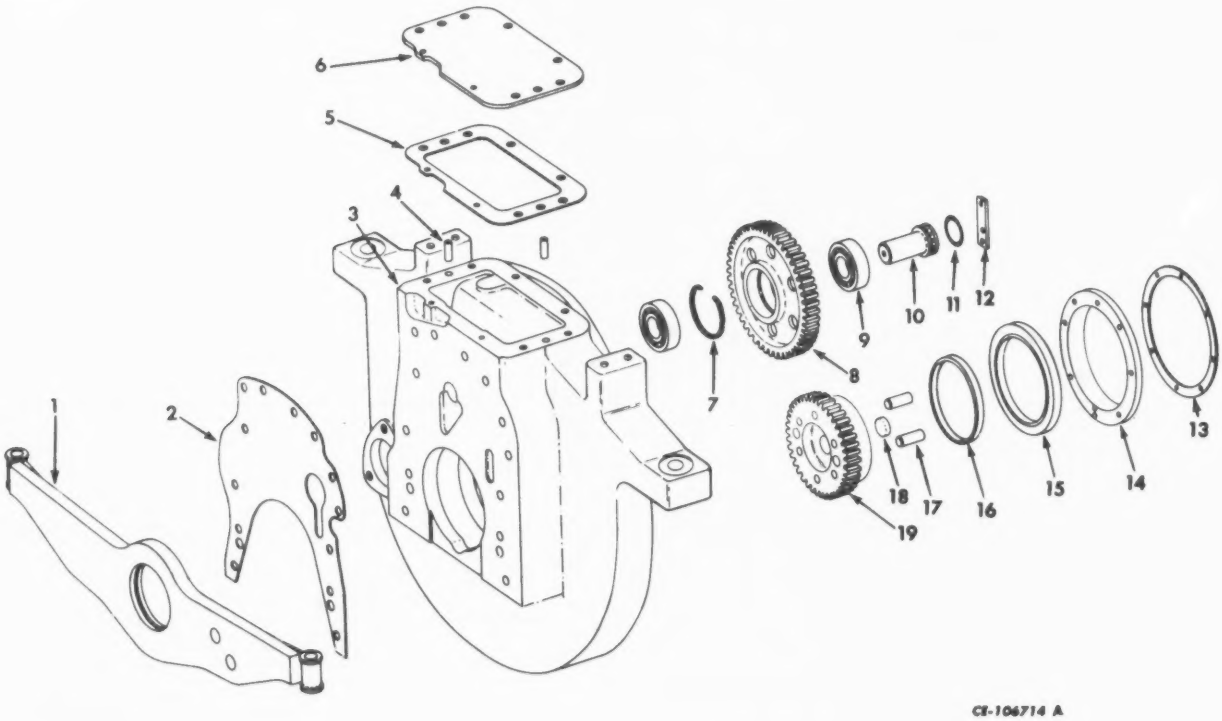
**(H-100C, 560 and D-120C)**

| | | |
|---|---|---|
| 4 | 670 929 C2 | HOUSING, flywheel |
| | 24 874 R1 | SCREW, 1-3/4" long hex-hd cap (13) |
| | 24 877 R1 | SCREW, 2-1/2" long hex-hd cap (4) |
| | 25 976 R1 | WASHER, hardened (17) |
| 5 | | SLEEVE, crankshaft oil seal wear (Order PACKAGE, 678 533 C91) |
| 6 | | OIL SEAL, crankshaft rear (Order PACKAGE, 678 533 C91) |
| 9 | 304 615 R22 | SUPPORT, front engine |
| | 678 533 C91 | PACKAGE, crankshaft rear oil seal field service (Single lipped) (Will work for PACKAGE, 601 673 C91 and 349 299 R91) (Consists of OIL SEAL and SLEEVE) |

**(330 and 340)**

| | | |
|---|---|---|
| 4 | 349 367 R2 | HOUSING, flywheel |
| | 24 874 R1 | SCREW, 1-3/4" long hex-hd cap (13) |
| | 24 877 R1 | SCREW, 2-1/2" long hex-hd cap (4) |
| | 25 976 R1 | WASHER, hardened (17) |
| 5 | | SLEEVE, crankshaft oil seal wear (Order PACKAGE, 678 536 C91) |
| 6 | | OIL SEAL, crankshaft rear (Order PACKAGE, 678 536 C91) |
| 10 | 701 327 C2 | SUPPORT, front engine |
| | 678 536 C91 | PACKAGE, crankshaft rear oil seal field service (Double lipped)(Will work for PACKAGE, 601 673 C91) (Consists of OIL SEAL & SLEEVE) |

FLYWHEEL HOUSING, FRONT SUPPORT, POWER TAKE-OFF GEARS AND RELATED PARTS
(TD-25C)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 612 301 C12 | SUPPORT, front engine |
| | 25 908 R1 | BOLT, engine mounting (Front) (phc) |
| | 238 455 R1 | WASHER, hardened (2) |
| 2 | 323 815 R2 | GASKET, flywheel housing |
| 3 | 612 303 C21 | HOUSING ASSEMBLY, flywheel (Composed of - |
| | | § 1 HOUSING |
| | | 2 PIN 141 283 |
| | | 1 PLUG 444 576 |
| | | 1 PLUG 273 469 |
| | | 1 PLUG 9 409 949 ) |
| | 24 874 R1 | SCREW, hex-hd cap (11) |
| | 24 878 R1 | SCREW, hex-hd cap (2) |
| | 25 976 R1 | WASHER, hardened (13) |
| 4 | 141 283 | PIN, 1/2 x 1" dowel (2) |
| 5 | 316 226 R1 | GASKET, flywheel housing cover |
| 6 | 316 225 R1 | COVER, flywheel housing (See NOTE) |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 24 861 R1 | SCREW, hex-hd cap (6) |
| | 25 896 R1 | WASHER, 3/8" hardened (2) |
| | 26 273 R1 | WASHER, 1/2" hardened (6) |
| 7 | 316 222 R1 | RING, power take-off idler gear snap |
| 8 | 316 221 R1 | GEAR, power take-off idler |
| 9 | ST-235 | BEARING, power take-off idler gear (2) |
| 10 | 316 223 R1 | SHAFT, power take-off idler gear |
| 11 | 25 020 R1 | RING, power take-off idler gear shaft seal |
| 12 | 316 224 R1 | PLATE, power take-off lock |
| | 26 309 R1 | SCREW (3) |
| 13 | 318 424 R1 | GASKET, crankshaft rear oil seal |
| 14 | 349 297 R1 | RETAINER, crankshaft rear oil seal |
| | 26 306 R1 | SCREW, hex-hd cap (Nylok) (8) |
| 15 | | OIL SEAL, crankshaft rear (Order PACKAGE, 678 536 C91) |

§ – Not Furnished Separately.

NOTE: For Power Shift not equipped with Model 2540 SERIES C Hydraulic Control Unit.



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FLYWHEEL HOUSING, FRONT SUPPORT, POWER TAKE-OFF GEARS AND RELATED PARTS – Continued (TD-25C)** |
| 16 | | SLEEVE, crankshaft oil seal wear (Order PACKAGE, 678 536 C91) |
| 17 | 19 968 R1 | PIN, power take-off gear dowel (2) |
| 18 | 41 162 D | PLUG, cup |
| 19 | 316 216 R11 | GEAR w/two PIN, 19 968 R1 and PLUG, 41 162 D, power take-off (42-T) |
| | 138 313 | CAPSCREW (2) |
| | 683 086 C1 | "O" RING, flywheel housing to crankcase (1-3/8" ID) |
| | 678 536 C91 | PACKAGE, rear oil seal (Consists of OIL SEAL and SLEEVE) |

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

## FUEL SYSTEM 11

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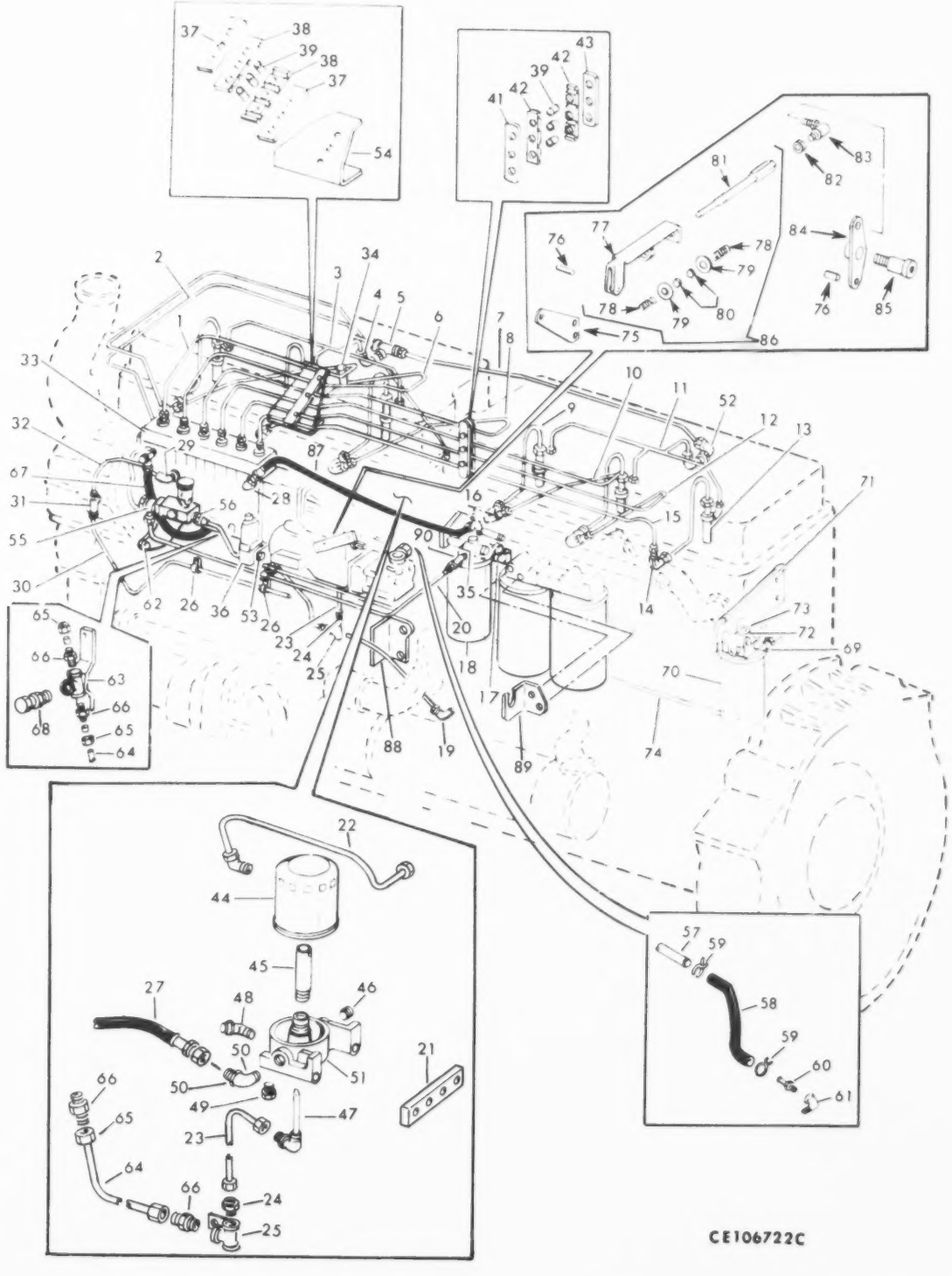
FUEL INJECTION PUMP PIPES, FINAL FUEL FILTER
AND RELATED PARTS



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FUEL INJECTION PUMP PIPES, FINAL FUEL FILTER AND RELATED PARTS – Continued** |
| 1 | 673 150 C2 | PIPE, injection (Cylinder No. 1) |
| 2 | 674 289 C91 | TUBE w/NUT, 915 499 R1, and SLEEVE, 915 500 R1, nozzle fuel return |
| | 915 499 R1 | NUT |
| | 915 500 R1 | SLEEVE |
| | 278 040 R2 | SLEEVE |
| | 278 041 R1 | NUT |
| | 447 264 R91 | CLIP, fuel return tube |
| | 115 093 | WASHER, lock |
| 3 | 674 264 C1 | TUBE, front injection fuel return |
| 4 | 327 072 R1 | ELBOW, valve housing (2) |
| | or | |
| 4 | 338 552 R1 | ELBOW, valve housing (2) |
| | 105 454 | GASKET (2) |
| | 25 950 R1 | NUT, jam |
| | 25 976 R1 | WASHER, hardened |
| 5 | 610 713 C1 | TEE, nozzle fuel return tube |
| 6 | 673 151 C2 | PIPE, injection (Cylinder No. 2) |
| 7 | 674 266 C91 | TUBE w/two NUT, 915 499 R1 and SLEEVE, 915 500 R1, nozzle fuel return |
| | 915 499 R1 | NUT, tube (2) |
| | 915 500 R1 | SLEEVE, tube (2) |
| 8 | 673 152 C2 | PIPE, injection (Cylinder No. 3) |
| 9 | 670 992 C2 | PIPE, injection (6) |
| 10 | 673 153 C2 | PIPE, injection (Cylinder No. 4) |
| 11 | 674 265 C1 | TUBE, rear injection fuel return |
| 12 | 673 154 C2 | PIPE, injection (Cylinder No. 5) |
| 13 | | NOZZLE and NOZZLE HOLDER ASSY. (Refer to "Nozzle and Holder") |
| 14 | 677 063 C1 | CONNECTOR (6) |
| | 368 269 R1 | "O" RING (6) |
| 15 | 673 155 C2 | PIPE, injection (Cylinder No. 6) |
| 16 | 606 845 C1 | ELBOW, 90° flex (H-100C) - 13744 and Below (H-560) - 13463 and Below (330 and 340) - 14513 and Below (TD-25C and D-120C) - % and Below |
| 16 | 444 166 | ELBOW, 90° street |
| | or | |
| 16 | 444 480 | ELBOW, 90° street (H-100C) - 13745 and Up (H-560) - 13464 and Up (330 and 340) - 14514 and Up (TD-25C & D-120C) - % and Up |
| 17 | 674 724 C1 | ELBOW (Filter Header) (H-100C) - 13744 and Below (H-560) - 13463 and Below (330 & 340) - 14513 and Below (TD-25C & D-120C) - % and Below |
| 18 | 674 293 C1 | FILTER, fuel (Final) |
| | 444 654 | PLUG |
| | 25 784 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (2) |
| | 39 677 DA | VALVE, bleed |
| 19 | 278 099 R1 | ELBOW, pump and adapter oil tube (At crankcase) |
| | 278 040 R2 | SLEEVE |
| | 278 041 R1 | NUT |
| 20 | 684 620 C91 | TUBE w/two NUT, 265 205 R1 and two SLEEVE, 265 204 R1 |
| | 265 205 R1 | NUT, hex-hd cap (2) |
| | 24 845 R1 | SLEEVE (2) |
| | 115 093 | CLIP, fuel tube |
| | 127 507 | SPACER, fuel tube clip |
| 21 | 670 604 C1 | SUPPORT, fuel reservoir (H-100C) - 13744 and Below (H-560) - 13463 and Below (330 & 340) - 14513 and Below (TD-25C & D-120C) - % and Below |
| | 24 845 R1 | SCREW, hex-hd cap (2) |
| | 115 093 | WASHER, flat (2) |
| | 103 344 | WASHER, lock (2) |
| 22 | 670 605 C11 | TUBE w/two SLEEVE, 265 204 R1 and two NUT, 265 205 R1, fuel filter reservoir (H-100C) - 13744 and Below (H-560) - 13463 and Below (330 & 340) - 14513 and Below (TD-25C & D-120C) - % and Below |
| | 265 205 R1 | NUT (2) |
| | 265 204 R1 | SLEEVE (2) |
| 23 | 683 322 C91 | TUBE w/two SLEEVE, 915 500 R1 and two NUT, 915 499 R1, reservoir bleed (H-100C) - 13744 and Below (H-560) - 13463 and Below (330 & 340) - 14513 and Below (TD-25C & D-120C) - % and Below |
| | 915 499 R1 | NUT (2) |
| | 915 500 R1 | SLEEVE (2) |
| 24 | 606 885 C1 | CONNECTOR (H-100C) - 13744 and Below (H-560) - 13463 and Below (330 & 340) - 14513 and Below (TD-25C & D-120C) - % and Below |

(%) – Serial Number not yet available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FUEL INJECTION PUMP, PIPES, FINAL FUEL FILTER AND RELATED PARTS - Continued** |
| 25 | 701 348 C1 | CONNECTOR, three-way fuel return<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 26 | 447 264 R91 | CLIP, pump and adapter oil tube |
| 27 | 702 845 C1 | HOSE w/37° flare FITTINGS, reservoir to injection pump<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 28 | 9 402 838 | ELBOW, 45° (Used w/HOSE, 702 845 C1 and 686 803 C1) |
| 28 | 118 755 | ELBOW, 90° (Used w/HOSE, 688 187 C1) |
| 29 | 319 615 R1 | ELBOW, injection pump lubricating oil inlet |
| 30 | 670 598 C11 | TUBE w/two NUT, 915 499 R1 and two SLEEVE, 915 500 R1, injection pump lubricating oil inlet |
| | 915 499 R1 | NUT |
| | 915 500 R1 | SLEEVE |
| 31 | 670 596 C1 | TEE w/ORIFICE |
| 32 | 670 597 C11 | TUBE w/two NUT, 915 499 R1 and two SLEEVE, 915 500 R1, injection pump lubricating oil inlet |
| | 915 499 R1 | NUT (2) |
| | 915 500 R1 | SLEEVE (2) |
| 33 | | (See Individual Engine Variation) |
| 34 | 673 527 C1 | CLAMP, injection pipe (2) |
| | 258 079 C1 | GROMMET, clamp |
| | 25 222 R1 | SCREW, hex-hd cap |
| | 684 548 C1 | NUT, nylon |
| 35 | 612 276 C2 | HEADER, final fuel filter |
| | 299 404 C1 | CLIP, fuel tube |
| | 127 507 H | SPACER, fuel tube clip |
| 36 | 670 426 C1 | SUPPORT, injection pump bracket |
| | 25 522 R1 | NUT (3) |
| | 21 318 R1 | SCREW, 2-1/2" long hex-hd cap |
| | 140 483 H | SCREW, 1-1/4" long hex-hd cap (3) |
| | 24 847 R1 | SCREW, 5" long hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (7) |
| 37 | 670 594 C1 | CLAMP, injection pipe clamp (2) |
| | 27 020 R1 | SCREW, hex-hd cap (3) |
| | 27 616 R1 | WASHER, lock hardened (3) |
| 38 | 670 595 C1 | PAD, injection pipe (2) |
| 39 | 670 107 C1 | SPACER, injection pipe clamp (6) |
| 41 | 264 143 R1 | CLAMP, injection pipe support |
| 42 | 670 106 C1 | PAD, injection pipe clamp (2) |
| 43 | 670 834 C1 | CLAMP, injection pipe |
| | 26 310 R1 | SCREW, hex-hd cap |
| | 26 999 R1 | SCREW, hex-hd cap (3) |
| | 27 616 R1 | WASHER, hardened (3) |
| | 25 896 R1 | WASHER, hardened |
| 44 | 701 350 C1 | RESERVOIR, fuel<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 45 | 670 602 C1 | STANDPIPE, fuel inlet<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 46 | 444 654 | PLUG, pipe<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 47 | 682 760 C1 | STANDPIPE w/ELBOW, 606 296 C1 bleed<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 48 | 606 845 C1 | ELBOW, 90° flex<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 49 | 444 612 | PLUG, hex-hd pipe (2)<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |

(%) – Serial Number Not Yet Available



PRINTED IN UNITED STATES OF AMERICA

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FUEL INJECTION PUMP, PIPES, FINAL FUEL FILTER AND RELATED PARTS - Continued** |
| 50 | 9 402 838 | ELBOW<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 51 | 612 277 C2 | HEADER, fuel reservoir<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| | 24 515 R1 | SCREW, hex-hd cap (2) |
| | 103 321 | WASHER, lock (2) |
| | 103 341 | WASHER, flat (2) |
| 52 | 319 615 R1 | ELBOW, nozzle fuel return |
| 53 | 701 182 C1 | BRACKET, injection pump |
| 54 | | (See Individual Engine Variation) |
| 55 | 684 551 C1 | FITTING, fuel transfer pump outlet (Banjo) |
| 56 | | (See Individual Engine Variation) |
| 57 | 670 606 C1 | TUBE, aneroid |
| | 447 264 R91 | CLIP |
| | 20 285 H | WASHER |
| 58 | | HOSE, aneroid (HOSE, 3/16" ID x 5" long cut from bulk HOSE, 680 246 C1) |
| 59 | 299 486 R1 | CLAMP, aneroid hose (2) |
| 60 | 343 544 R91 | CONNECTOR, aneroid hose |
| | 444 476 | ELBOW |
| 61 | 278 099 R1 | ELBOW |
| | 278 040 R2 | SLEEVE |
| | 278 041 R1 | NUT |
| 62 | 682 905 C1 | PLATE, cover |
| | 26 674 R1 | SCREW, hex-hd cap (Nylok)(4) |
| | 27 616 R1 | WASHER, hardened (4) |
| | 682 906 C1 | GASKET, cover plate |
| 63 | 678 039 C91 | TEE and SUPPORT, fuel return tube |
| | 25 496 R1 | SCREW, hex-hd cap |
| 64 | 678 041 C1 | TUBE w/two SLEEVE, 915 500 R1 and two NUT, 915 499 R1, fuel return<br>(H-100C) - 13744 and Below<br>(H-560 ) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| | 915 500 R1 | SLEEVE (2) |
| 65 | 915 499 R1 | NUT (2)<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 66 | 606 673 C1 | CONNECTOR (2)<br>(H-100C) - 13744 and Below<br>(H-560) - 13463 and Below<br>(330 & 340) - 14513 and Below<br>(TD-25C & D-120C) - % and Below |
| 67 | 680 425 C3 | HOSE, fuel return |
| 68 | 702 843 C2 | ORIFICE, fuel return |
| 69 | | (See Individual Engine Variation) |
| 70 | | (See Individual Engine Variation) |
| 71 | | (See Individual Engine Variation) |
| 72 | | (See Individual Engine Variation) |
| 73 | | (See Individual Engine Variation) |
| 74 | | (See Individual Engine Variation) |
| 75 | | (See Individual Engine Variation) |
| 76 | 103 495 | PIN, rod end |
| | 107 762 | PIN, cotter |
| 77 | 670 936 C1 | TRUNNION |
| 78 | 305 867 R1 | SPRING, governor control (2) |
| 79 | 103 340 | WASHER, flat (2) |
| 80 | 23 697 R1 | RING, retaining (2) |
| 81 | | (See Individual Engine Variation) |
| 82 | | (See Individual Engine Variation) |
| 83 | | (See Individual Engine Variation) |
| 84 | | (See Individual Engine Variation) |
| 85 | | (See Individual Engine Variation) |
| 86 | | (See Individual Engine Variation) |
| 87 | 686 803 C1 | HOSE w/37° flare FITTINGS, final filter to injection pump<br>(H-100C) - 13745 to %<br>(H-560) - 13464 to %<br>(330 & 340) - 14514 to % |
| 87 | 688 187 C1 | HOSE w/45° flare FITTINGS, final filter to injection pump<br>% and Up |

(%) – Serial Number Not Yet Available.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FUEL INJECTION PUMP, PIPES, FINAL FUEL FILTER AND RELATED PARTS – Continued** |
| 88 | | (See Individual Engine Variation) |
| 89 | | (See Individual Engine Variation) |
| 90 | 606 845 C1 | ELBOW, 90° flex |
| | 383 186 R2 | CLIP, aneroid tube |
| | 24 839 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| | 678 026 C1 | WIRE, injection pump lock (2) |
| | 678 027 C1 | LOCK, injection pump seal wire (2) |
| | 680 246 C1 | HOSE, 3/16" ID x 120" long |
| | | **ENGINE VARIATIONS** |
| | | **(TD-25C)** |
| 33 | 684 440 C91 | (+) PUMP, fuel injection (Robert Bosch) (320HP @ 2100 RPM)(For TD-25 SERIES C Crawler Tractor and Arctic Crawler Tractor)(See NOTE A) |
| 33 | 684 446 C91 | (+) PUMP, fuel injection (Robert (Bosch) (338HP @ 2100 RPM)(For TD-25 SERIES C Crawler Tractor) (See NOTE A) |
| | 140 483 H | SCREW, hex-hd cap (4) |
| | 25 896 R1 | WASHER, hardened (4) |
| | 670 877 C1 | SEAL, high idle stop screw |
| | 670 249 C1 | GASKET, injection pump |
| | 684 493 C1 | SCREW, supply pump fitting |
| | 933 610 R1 | GASKET, supply pump fitting (3) |
| 54 | 703 531 C1 | SUPPORT, air cleaner front |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 56 | 684 550 C1 | CONNECTOR, fuel transfer pump inlet |
| 75 | 671 766 C1 | LEVER, injection pump |
| 81 | 678 065 C1 | ROD, trunnion |
| | 114 493 | NUT, hex jam |
| 82 | 9 413 936 | NUT, 5/16" lock |
| 83 | 310 673 R91 | JOINT, ball |
| 84 | 671 761 C91 | LEVER, governor control |
| 85 | 671 760 C1 | SHAFT, control lever |
| | 25 933 R1 | NUT |
| | 109 461 | FITTING, lub |
| | 49 496 D | WASHER |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **(H-100C and D-120C)** |
| 33 | 684 443 C91 | (+) PUMP, fuel injection (Robert Bosch)(320HP @ 2100 RPM)(See NOTE A) |
| | 117 272 | SCREW, 3/16" machine |
| | 140 483 H | SCREW, 1-1/4" long hex-hd cap (2) |
| | 25 498 R1 | SCREW, 1-5/8" long hex-hd cap (2) |
| | 670 877 C1 | SEAL, high idle stop screw |
| | 64 283 DBX | SWIVEL |
| | 25 896 R1 | WASHER, hardened (4) |
| | 20 600 R1 | WASHER, flat |
| | 670 249 C1 | GASKET, injection pump |
| | 684 493 C1 | SCREW, supply pump fitting |
| | 933 610 R1 | GASKET, supply pump fitting(3) |
| 54 | 703 531 C1 | SUPPORT, air cleaner front |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 56 | 684 550 C1 | CONNECTOR, fuel transfer pump inlet |
| 69 | 651 560 C2 | HEADER, primary filter |
| | 25 784 R1 | SCREW, hex-hd cap (2) |
| | 25 522 R1 | NUT, hex (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| | 444 612 | PLUG, pipe |
| 70 | 625 627 C1 | FILTER, primary filter |
| 71 | 681 803 C1 | BRACKET, primary filter |
| | 24 861 R1 | SCREW, hex-hd cap (2) |
| | 26 273 R1 | WASHER, hardened (2) |
| 72 | 265 024 R1 | ELBOW, 90° flex |
| 73 | 444 660 | PLUG, pipe (2) |
| 74 | 684 744 C91 | TUBE w/two SLEEVE, 265 066 R1 and two NUT, 265 067 R1, primary filter to fuel transfer pump |
| | 279 830 R1 | CLAMP, tube (Filter to supply pump |
| | 299 614 C1 | CLIP, primary filter to supply pump |
| | 447 264 R91 | CLIP, oil supply tube (2) |
| | 394 418 R1 | CUSHION, fuel tube |
| | 673 171 C1 | CUSHION, fuel tube |
| | 265 067 R1 | NUT (2) |
| | 262 038 R1 | NUT, speed |
| | 113 957 | SCREW, hex-hd cap |
| | 265 066 R1 | SLEEVE (2) |
| 75 | 671 767 C1 | LEVER, injection pump |
| 81 | 670 934 C1 | ROD, trunnion |

NOTE A: Pumps listed with symbol (+) are not available under part number shown. Order ReNEWed Pump Assy. as necessary, as shown in the Parts Catalog, PU-71. Also, refer to the PU-71 Parts Catalog for detail parts on all Robert Bosch pumps.



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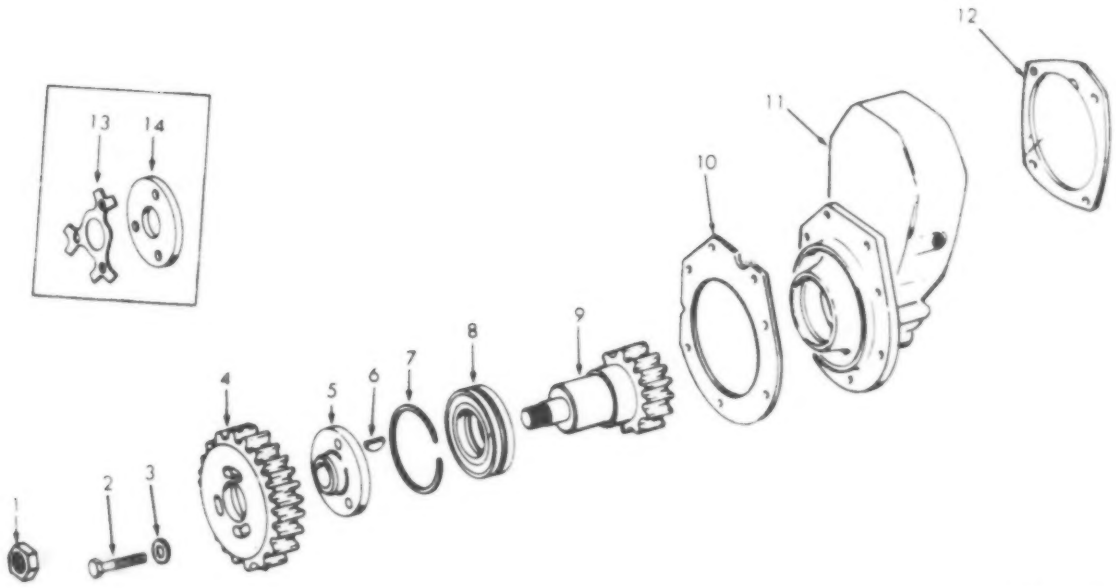
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **FUEL INJECTION PUMP, PIPES, FINAL FUEL FILTER AND RELATED PARTS – Continued** |
| | | **ENGINE VARIATIONS – Continued** |
| | | **(H-100C and D-120C) – Continued** |
| 88 | 618 890 C1 | BRACKET, control cable mounting |
| | 101 896 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 89 | 671 768 C1 | BRACKET, throttle control cable mounting |
| | 25 303 R1 | SCREW, 7-3/4" long hex-hd cap |
| | 24 861 R1 | SCREW, 1-1/4" long hex-hd cap |
| | 26 273 R1 | WASHER, hardened (2) |
| | | **(H-560)** |
| 33 | 684 450 C91 | (+) PUMP, fuel injection (Robert Bosch)(420 HP @ 2200 RPM)(See NOTE A) |
| | 117 272 | SCREW, 3/16" machine |
| | 140 483 H | SCREW, hex-hd cap (4) |
| | 670 877 C1 | SEAL, high idle stop screw |
| | 64 283 DBX | SWIVEL |
| | 25 896 R1 | WASHER, hardened (4) |
| | 20 600 R1 | WASHER, flat |
| | 670 249 C1 | GASKET, injection pump |
| | 684 493 C1 | SCREW, supply pump fitting (2) |
| | 933 610 R1 | GASKET, supply pump fitting (4) |
| 54 | 703 531 C1 | SUPPORT, air cleaner front |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 56 | 684 531 C1 | CONNECTOR, fuel transfer pump inlet |
| 75 | 671 767 C1 | LEVER, injection pump |
| 81 | 670 934 C1 | ROD, trunnion |
| 88 | 618 890 C1 | BRACKET, control cable mounting |
| | 101 896 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 89 | 671 768 C1 | BRACKET, throttle control cable mounting |
| | 25 303 R1 | SCREW, 7-3/4" long hex-hd cap |
| | 24 861 R1 | SCREW, 1-1/4" long hex-hd cap |
| | 26 273 R1 | WASHER, hardened (2) |
| | | **(330 and 340)** |
| 33 | 684 450 C91 | (+) PUMP, fuel injection (Robert Bosch)(420 HP @ 2200 RPM)(See NOTE A) |
| | 117 272 | SCREW, 3/16" machine |
| | 140 483 H | SCREW, hex-hd cap (4) |
| | 670 877 C1 | SEAL, high idle stop screw |
| | 64 283 DBX | SWIVEL |
| | 25 896 R1 | WASHER, hardened (4) |
| | 20 600 R1 | WASHER, flat |
| | 670 249 C1 | GASKET, injection pump |
| | 684 493 C1 | SCREW, supply pump fitting (2) |
| | 933 610 R1 | GASKET, supply pump fitting (4) |
| 54 | 701 353 C1 | BRACKET, injection pipe support |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 56 | 684 531 C1 | FITTING, banjo (fuel transfer pump inlet) |
| 75 | 674 513 C1 | LEVER, injection pump control |
| 81 | 670 934 C1 | ROD, trunnion |
| 86 | 670 933 C91 | TRUNNION ASSY. |
| 88 | 618 890 C1 | BRACKET, control cable mounting (On tappet side cover) |
| | 25 496 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 89 | 674 420 C1 | BRACKET, throttle control cable mounting |
| | 25 303 R1 | SCREW, 7-3/4" long hex-hd cap |
| | 24 861 R1 | SCREW, 1-1/4" long hex-hd cap |
| | 26 273 R1 | WASHER, hardened (2) |

NOTE A: Pumps listed with symbol (+) are not available under part number shown. Order ReNEWed Pump Assy. as necessary, as shown in the Parts Catalog PU-71. Also, refer to the PU-71 Parts Catalog for detail parts on all Robert Bosch pumps.

FUEL INJECTION PUMP DRIVE

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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 625 342 C1 | NUT, Esna |
| 2 | 25 238 R1 | SCREW, hex-hd cap (3) |
| 3 | 687 080 C1 | WASHER, pump drive gear (3) |
| 4 | 670 232 C1 | GEAR, drive (40-T) |
| 5 | 670 233 C1 | HUB, drive gear |
| 6 | 120 502 | KEY, 3/16 x 7/8" |
| 7 | 41 659 D | RING, bearing retainer snap |
| 8 | 615 769 C91 | BEARING, pinion drive shaft |
| | or | |
| 8 | 619 783 C91 | BEARING, pinion drive shaft |
| 9 | 670 974 C1 | GEAR, injection pump drive shaft |
| 10 | 278 816 R1 | GASKET, injection pump adapter housing |
| 11 | 684 523 C91 | HOUSING w/PLUG, 9 409 949, injection pump adapter |
| | 25 934 R1 | NUT (2) |
| | 24 911 R1 | SCREW, hex-hd cap (5) |
| | 25 896 R1 | WASHER, hardened (7) |
| 12 | 670 249 C1 | GASKET, injection pump |
| | 9 409 949 | PLUG |
| 13 | 670 722 C1 | PLATE, drive gear lock (Order three WASHER, 687 080 C1) |
| 14 | 337 178 R2 | PLATE, drive gear retainer (Order three WASHER, 687 080 C1) |



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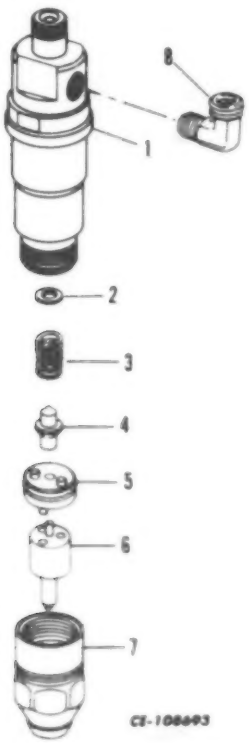
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **NOZZLE AND NOZZLE HOLDER** |
| 1 | | BODY (Not Furnished Separately) |
| 2 | 615 109 C1 | SHIM (.077") (x) |
| 2 | 615 110 C1 | SHIM (.075") (x) |
| 2 | 615 111 C1 | SHIM (.073") (x) |
| 2 | 615 112 C1 | SHIM (.071") (x) |
| 2 | 615 113 C1 | SHIM (.069") (x) |
| 2 | 615 114 C1 | SHIM (.067") (x) |
| 2 | 615 115 C1 | SHIM (.065") (x) |
| 2 | 615 116 C1 | SHIM (.063") (x) |
| 2 | 615 117 C1 | SHIM (.061") (x) |
| 2 | 615 118 C1 | SHIM (.059") (x) |
| 2 | 615 119 C1 | SHIM (.057") (x) |
| 2 | 615 120 C1 | SHIM (.055") (x) |
| 2 | 615 121 C1 | SHIM (.053") (x) |
| 2 | 615 122 C1 | SHIM (.051") (x) |
| 2 | 615 123 C1 | SHIM (.049") (x) |
| 2 | 615 124 C1 | SHIM (.047") (x) |
| 2 | 615 125 C1 | SHIM (.045") (x) |
| 2 | 615 126 C1 | SHIM (.043") (x) |
| 2 | 615 127 C1 | SHIM (.041") (x) |
| 2 | 615 128 C1 | SHIM (.039") (x) |
| 3 | 615 105 C1 | SPRING (6) |
| 4 | 615 106 C1 | SEAT, spring (6) |
| 5 | 615 107 C1 | PLATE, intermediate (6) |
| 6 | 684 476 C1 | NOZZLE (Nozzle Assy.)(A & B) (6) |
| 6 | 685 357 C1 | NOZZLE (Nozzle Assy.)(C & D) (6) |
| 7 | 619 519 C2 | NUT, nozzle cap (6) |
| 8 | 615 923 C1 | ELBOW |




Parts without letters after the description indicates the part is used for all assemblies listed below.

| | | |
|---|---|---|
| A | 684 475 C91 | NOZZLE and NOZZLE HOLDER ASSY. (Order ReNEWed NOZZLE and NOZZLE HOLDER ASSY., 749 092 C91)(For TD-25C, H-100C and D-120C) |
| B | 749 092 C91 | NOZZLE and NOZZLE HOLDER ASSY., ReNEWed (Will work for NOZZLE and NOZZLE HOLDER ASSY., 684 475 C91)(For TD-25C, H-100C and D-120C) |
| C | 684 658 C91 | NOZZLE and NOZZLE HOLDER ASSY. (Order ReNEWed NOZZLE and NOZZLE HOLDER ASSY., 749 098 C91)(For H-560, 330 and 340) |
| D | 749 098 C91 | NOZZLE and NOZZLE HOLDER ASSY., ReNEWed (Will work for NOZZLE and NOZZLE HOLDER ASSY., 684 658 C91)(For H-560, 330 and 340) |

(x) – As Required.

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REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

## LUBRICATION 13

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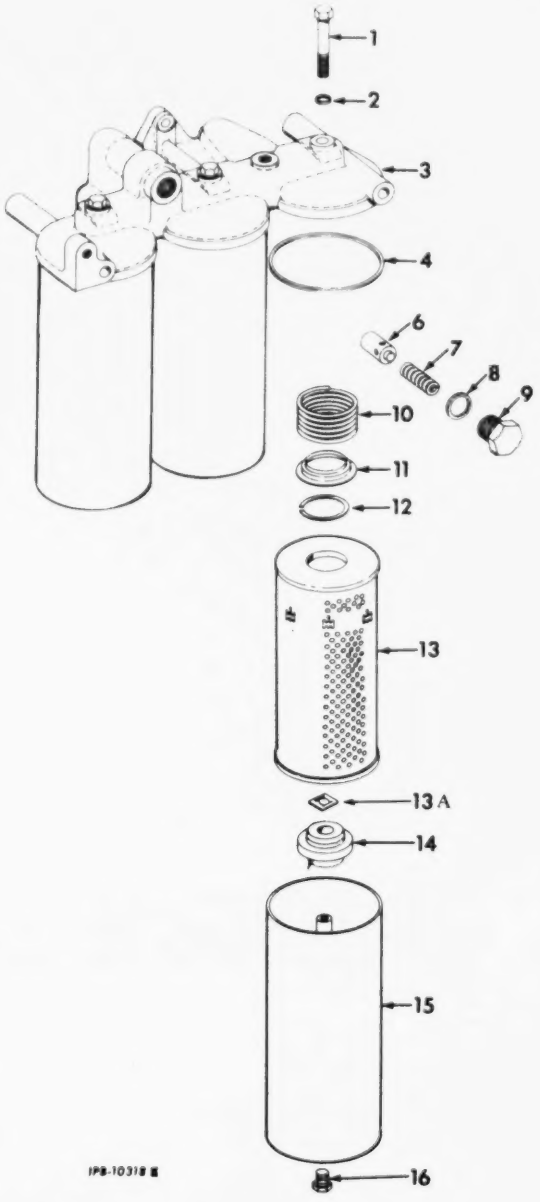
LUBRICATING OIL FILTER
(For TD-25 SERIES C - % and Below)
(H-100C and D-120C - 10874 and Below)
(330 and 340 - 11039 and Below)
(H-560 - 10836 and Below)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 323 878 R1 | BOLT, lubricating oil filter case retainer (3) |
| 2 | 306 420 R1 | WASHER, filter case retainer bolt (3) |
| | or | |
| 2 | 313 221 R1 | WASHER, filter case retainer bolt (3) |
| 3 | 601 808 C91 | HEAD, lubricating oil filter mounting (Includes Ref. Nos. 6 thru 9) |
| 4 | 13 841 D | GASKET, lubricating oil filter case (3) |
| 6 | 279 842 R1 | VALVE, lubricating oil filter by-pass |
| 7 | 303 799 R1 | SPRING, lubricating oil filter by-pass valve |
| 8 | 120 428 | GASKET, lubricating oil filter by-pass valve nut |
| 9 | 278 466 R1 | NUT, lubricating oil filter by-pass valve |
| 10 | 265 543 R1 | SPRING, lubricating oil filter element retainer (3) |
| 11 | 279 843 R2 | RETAINER, lubricating oil filter element sealing cup and spring (3) |
| 12 | 279 762 R1 | RING, lubricating oil filter element sealing cup retainer (3) |
| 13 | | ELEMENT (Order PACKAGE, 602 998 C91) |
| 13A | 317 598 R1 | NUT, spring (3) |
| 14 | 279 840 R2 | GUIDE and SEAT, lubricating oil filter element lower (3) |
| | or | |
| 14 | 310 382 R2 | GUIDE and SEAT, lubricating oil filter element lower (3) |
| 15 | 312 048 R92 | CASE, lubricating oil filter (3) |
| 16 | 445 078 | PLUG, hex-hd pipe (3) |
| | 119 937 | GASKET, annular (3) |
| | 602 998 C91 | PACKAGE, lubricating oil filter element (Consists of ELEMENT and GASKET, 13841-D) (3) |
| | 445 686 | PLUG, 3/8" sq-hd pipe |

(%) – Serial Number Not Yet Available.



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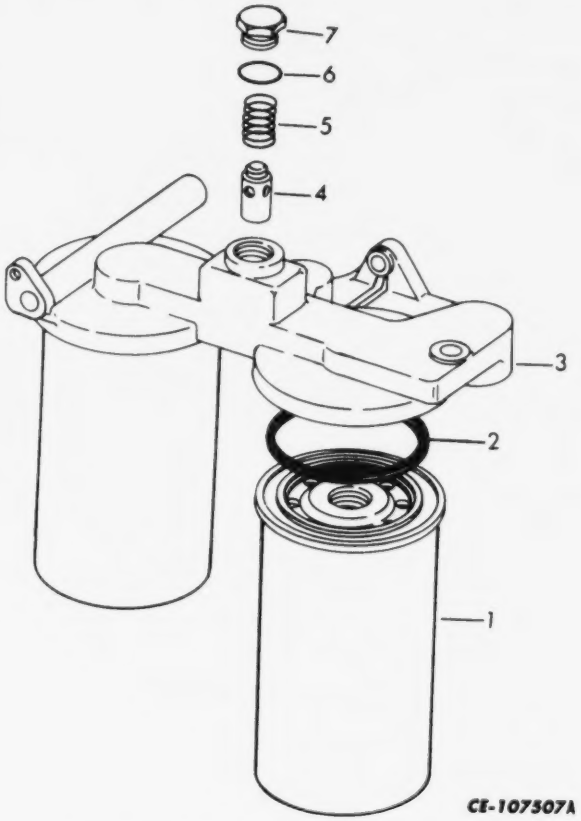
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

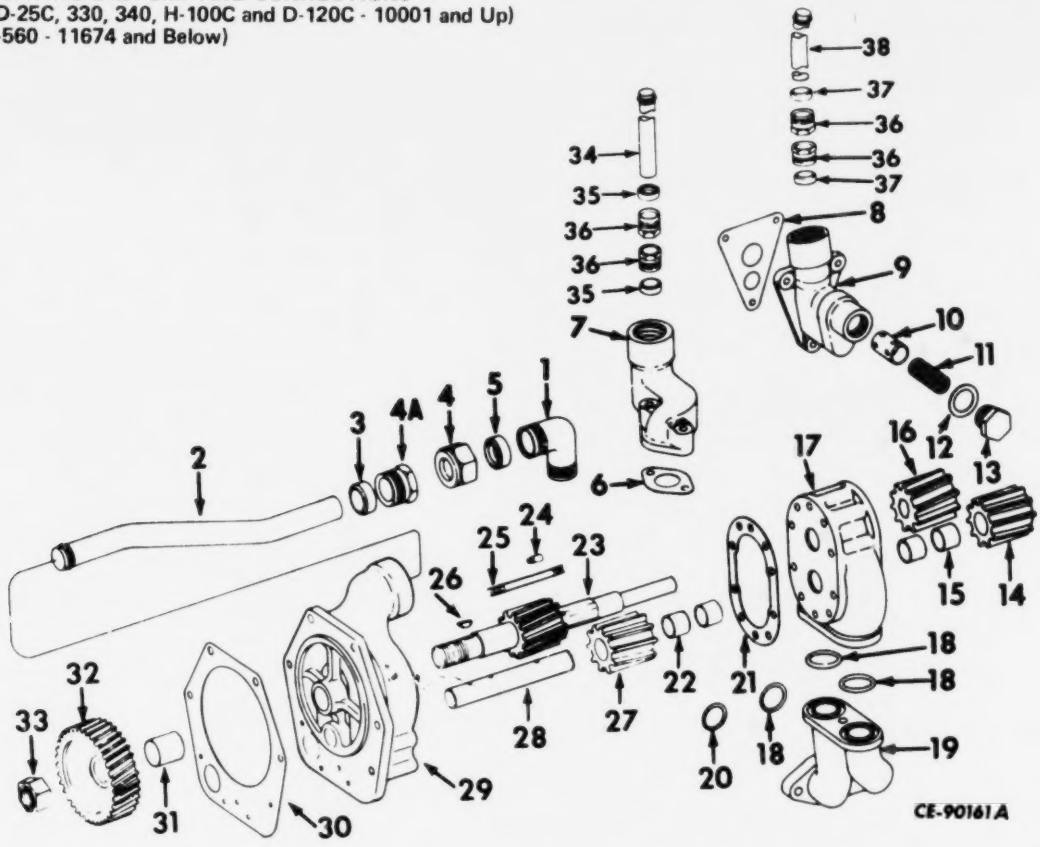
LUBRICATING OIL FILTER
(For TD-25C – % and Up)
(H-100C and D-120C – 10875 and Up)
(330 and 340 – 11040 and Up)
(H-560 – 10837 and Up)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 684 206 C2 | FILTER w/GASKET, lub oil (Spin-On) (2) |
| 2 | 687 111 C1 | GASKET, lube oil filter (2) |
| 3 | 684 452 C91 | HEADER, lub oil filter (Includes Ref. Nos. 4, 5, 6 and 7) |
| | 24 863 R1 | SCREW, 1-3/4" long hex-hd cap |
| | 25 303 R1 | SCREW, 7-3/4" long hex-hd cap |
| | 26 273 R1 | WASHER, hardened |
| 4 | 601 917 C1 | VALVE |
| 5 | 601 916 C1 | SPRING |
| 6 | 120 428 C1 | GASKET |
| 7 | 278 466 R1 | NUT, valve |

(%) – Serial Number Not Yet Available.

LUBRICATING OIL PUMP AND CONNECTIONS
(For TD-25C, 330, 340, H-100C and D-120C - 10001 and Up)
(For H-560 - 11674 and Below)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 306 157 R1 | ELBOW, 90° sealastic (1" tube) |
| 2 | 701 175 C1 | PIPE, oil pump to cooler lubrication |
| 3 | 338 619 R1 | SEAL RING, sealastic (1" tube) |
| 4 | 279 472 R91 | NUT w/COLLAR, sealastic (1" tube) |
| 4A | 306 156 R1 | NUT |
| 5 | 338 700 R91 | FERRULE and SEAL RING |
| 6 | 279 384 R2 | GASKET, lubricating oil cooler outlet elbow |
| 7 | 310 102 R1 | ELBOW, lubricating oil cooler outlet |
| | 24 842 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 8 | 278 467 R1 | GASKET, lubricating oil pressure regulating valve body |
| 9 | 278 463 R1 | BODY, lubricating oil pressure regulating valve |
| | 140 483 H | SCREW, hex-hd cap (3) |
| | 25 896 R1 | WASHER, hardened (3) |
| 10 | 278 464 R1 | VALVE, lubricating oil pressure regulating |
| 11 | 278 465 R1 | SPRING, lubricating oil pressure regulating valve |
| 12 | 120 428 | GASKET, lubricating oil pressure regulating valve nut |
| 13 | 278 466 R1 | NUT, lubricating oil pressure regulating valve |
| 14 | 607 122 C21 | GEAR w/two BUSHING, 304 315 R1, lubricating oil scavenging pump idler |
| 15 | 304 315 R1 | BUSHING, lubricating oil scavenging pump idler gear (2) |
| 16 | 607 121 C1 | GEAR, lubricating oil scavenging pump body |
| 17 | 277 440 R11 | BODY w/DOWEL, 46 052 D, lubricating oil scavenging pump |
| 18 | 293 739 R1 | "O" RING, oil scavenging pump manifold (1-3/8 x 1-5/8 x 1/8") (3) |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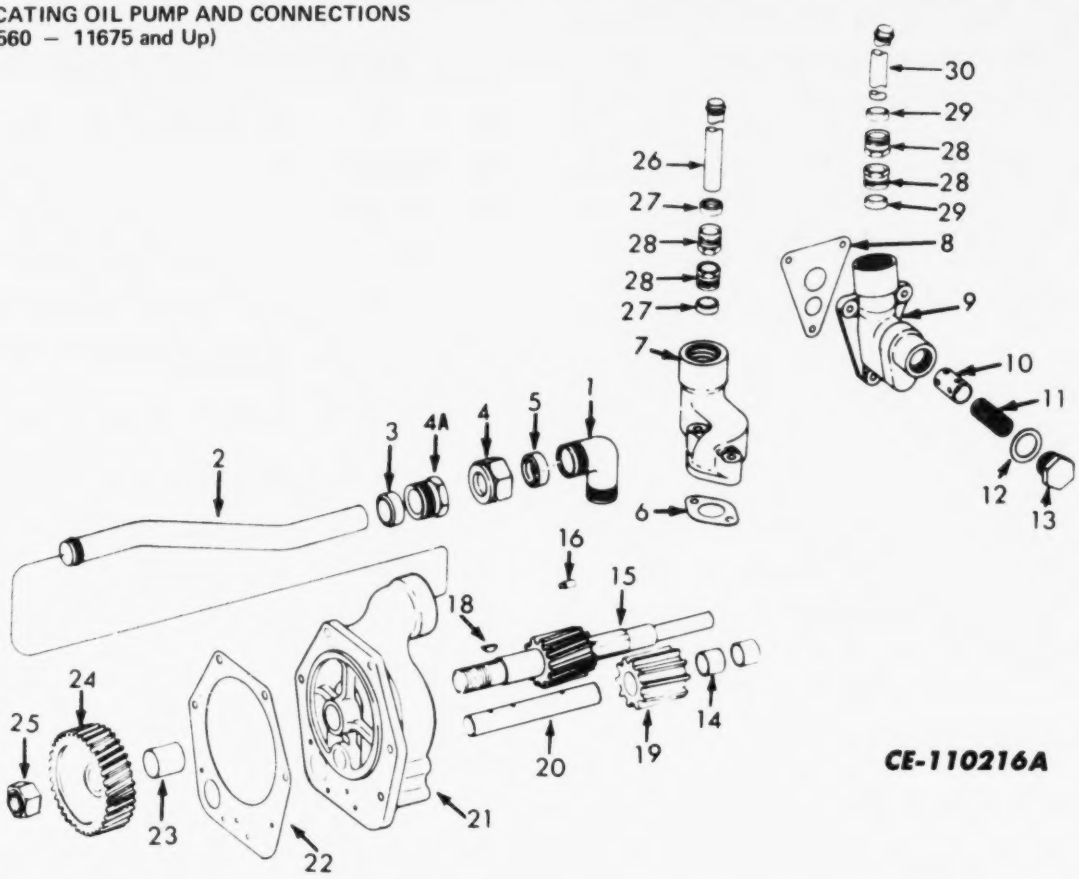
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **LUBRICATING OIL PUMP AND CONNECTIONS – Continued (For TD-25C, 330 & 340, H-100C and D-120C – 10001 and Up) (For H-560 – 11674 and Below)** |
| 19 | 277 446 R1 | MANIFOLD, 4" oil scavenging pump |
| | 24 856 R1 | SCREW, hex-hd cap |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 26 272 R1 | WASHER, hardened |
| | 25 896 R1 | WASHER, hardened (2) |
| 20 | 252 483 R1 | "O" RING, oil scavenging pump manifold (1-1/4 x 1-1/2 x 1/8") |
| 21 | 277 525 R2 | GASKET, lubricating oil scavenging pump body |
| 22 | 304 315 R1 | BUSHING, lubricating oil pump idler gear (2) |
| 23 | 701 169 C91 | SHAFT w/GEAR, lubricating oil and water pump drive |
| 24 | 46 052 D | DOWEL, lubricating oil pump body |
| 25 | 58 544 D | STUD, lubricating oil pump body (8) |
| 26 | 124 546 | KEY, 5/32 x 5/8" Woodruff (Lubricating oil and water pump drive gear) |
| 27 | 607 220 C21 | GEAR w/two BUSHING, 304 315 R1, oil pump body idler |
| 28 | 670 193 C1 | SHAFT, lubricating oil pump idler |
| 29 | 670 192 C11 | BODY ASSEMBLY, lubricating oil pump (Composed of - |
| | | § 1 BODY |
| | | 1 BUSHING 303 940 R1 |
| | | 1 DOWEL 46 052 D |
| | | 1 SHAFT 670 193 C1 |
| | | 8 STUD 58 544 D ) |
| | 214 441 | NUT (5) |
| | 354 921 R1 | SCREW, hex-hd cap |
| | 259 555 R1 | SCREW, hex-hd cap |
| | 22 436 R1 | SCREW, hex-hd cap (2) |
| | 24 915 R1 | SCREW, hex-hd cap |
| | 24 914 R1 | SCREW, hex-hd cap |
| | 103 321 | WASHER, lock (8) |
| 30 | 277 492 R2 | GASKET, lubricating oil and water pump |
| 31 | 303 940 R1 | BUSHING, oil pump body |
| 32 | 670 190 C1 | GEAR, lubricating oil and water pump drive |
| 33 | 625 342 C1 | NUT (Lubricating oil and water pump drive gear) |
| 34 | | (See Individual Engine Variation) |
| 35 | 338 619 R1 | SEAL RING, sealastic (1" tube) (2) |
| 36 | 306 156 R1 | NUT, sealastic (4) |
| 37 | 338 700 R91 | FERRULE and SEAL RING (2) |
| 38 | 279 685 R21 | TUBE, filter outlet to regulating body |
| | 46 052 D | DOWEL, lubricating oil scavenging pump body |
| | 345 049 R1 | FLINGER, lubricating oil pump |
| | | **ENGINE VARIATIONS** |
| | | **(All Models Except H-100C PAYloader)** |
| 34 | 279 684 R21 | PIPE, oil cooler to filter |
| | | **(H-100C PAYloader)** |
| 34 | 310 158 R21 | PIPE, oil cooler to filter |

§ – Not Furnished Separately.

LUBRICATING OIL PUMP AND CONNECTIONS
(For H-560 — 11675 and Up)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 306 157 R1 | ELBOW, 90° sealastic (1" tube) |
| 2 | 701 175 C1 | PIPE, oil pump to cooler lubrication |
| 3 | 338 619 R1 | SEAL RING, sealastic (1" tube) |
| 4 | 279 472 R91 | NUT w/COLLAR, sealastic (1" tube) |
| 4A | 306 156 R1 | NUT |
| 5 | 338 700 R91 | FERRULE and SEAL RING |
| 6 | 279 384 R2 | GASKET, lubricating oil cooler outlet elbow |
| 7 | 310 102 R1 | ELBOW, lubricating oil cooler outlet |
| | 24 842 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 8 | 278 467 R1 | GASKET, lubricating oil pressure regulating valve body |
| 9 | 278 463 R1 | BODY, lubricating oil pressure regulating valve |
| | 140 483 H | SCREW, hex-hd cap (3) |
| | 25 896 R1 | WASHER, hardened (3) |
| 10 | 278 464 R1 | VALVE, lubricating oil pressure regulating |
| 11 | 278 465 R1 | SPRING, lubricating oil pressure regulating valve |
| 12 | 120 428 | GASKET, lubricating oil pressure regulating valve nut |
| 13 | 278 466 R1 | NUT, lubricating oil pressure regulating valve |
| 14 | 304 315 R1 | BUSHING, lubricating oil pump idler gear (2) |
| 15 | 701 284 C91 | SHAFT w/GEAR, lubricating oil and water pump drive |
| 16 | 46 052 D | DOWEL, lubricating oil pump body |
| 18 | 124 546 | KEY, 5/32 x 5/8" Woodruff (Lubricating oil and water pump drive gear) |



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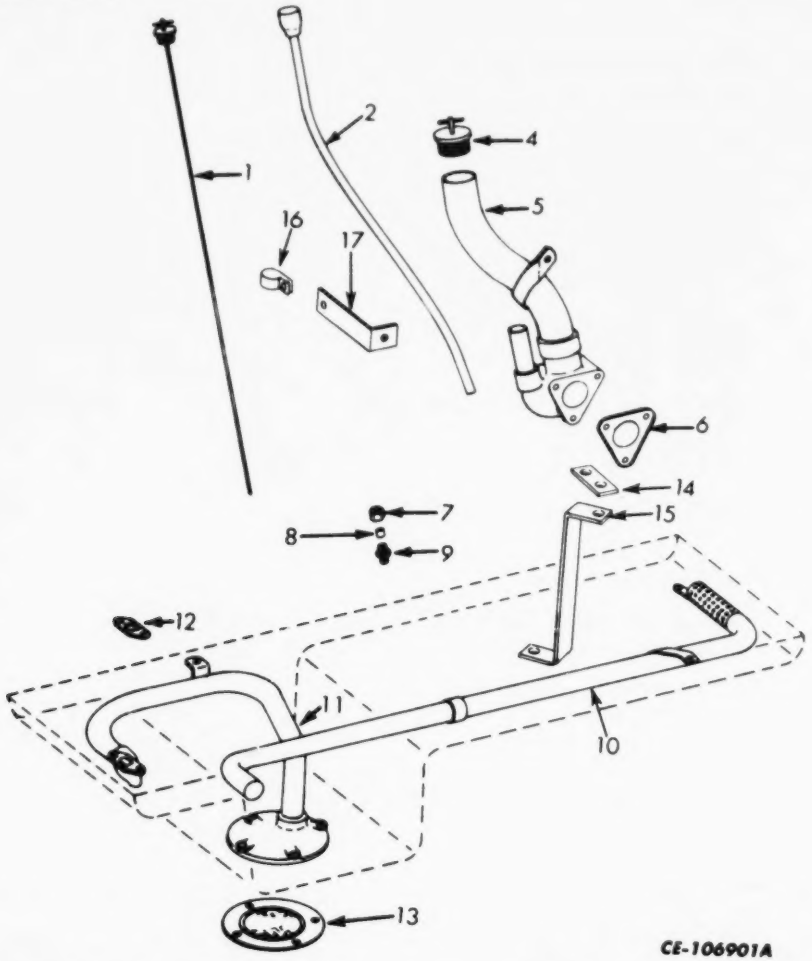
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **LUBRICATING OIL PUMP AND CONNECTIONS – Continued (For H-560 – 11675 and Up)** |
| 19 | 607 220 C21 | GEAR w/two BUSHING, 304 315 R1, oil pump body idler |
| 20 | 670 473 C1 | SHAFT, lubricating oil pump idler |
| 21 | 701 283 C91 | BODY ASSEMBLY, lubricating oil pump (Composed of - § 1 BODY 1 BUSHING 303 940 R1 1 DOWEL 46 052 D 1 SHAFT 670 473 C1 ) |
| | 214 441 | NUT (Type 8) (5) |
| | 354 921 R1 | SCREW, hex-hd cap |
| | 259 555 R1 | SCREW, hex-hd cap |
| | 22 436 R1 | SCREW, hex-hd cap (2) |
| | 24 915 R1 | SCREW, hex-hd cap |
| | 24 914 R1 | SCREW, hex-hd cap |
| | 103 321 | WASHER, 3/8" lock (8) |
| 22 | 277 492 R2 | GASKET, lubricating oil and water pump |
| 23 | 303 940 R1 | BUSHING, oil pump body |
| 24 | 670 190 C1 | GEAR, lubricating oil and water pump drive |
| 25 | 625 342 C1 | NUT (Lubricating oil and water pump drive gear) |
| 26 | 279 684 R21 | PIPE, oil cooler to filter |
| 27 | 338 619 R1 | SEAL RING, sealastic (1" tube)(2) |
| 28 | 306 156 R1 | NUT, sealastic (4) |
| 29 | 338 700 R91 | FERRULE and SEAL RING (2) |
| 30 | 279 685 R21 | TUBE, filter outlet to regulating body |
| | 46 052 D | DOWEL, lubricating oil scavenging pump body |
| | 345 049 R1 | FLINGER, lubricating oil pump |

§ – Not Furnished Separately.

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

## OIL GAUGE, FILLER PIPE, LUBRICATING SUCTION PIPING AND RELATED PARTS




CE-106901A

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | (See Individual Engine Variation) |
| 2 | | (See Individual Engine Variation) |
| 4 | 303 761 R91 | CAP, oil filler |
| 5 | | (See Individual Engine Variation) |
| 6 | 278 603 R1 | GASKET, oil filler elbow |
| 7 | 265 067 R1 | NUT, oil level gauge sleeve connector |
| 8 | 265 066 R1 | SLEEVE, oil level gauge sleeve connector |
| 9 | 319 816 R1 | CONNECTOR, oil level gauge sleeve |
| 10 | | (See Individual Engine Variation) |
| 11 | | (See Individual Engine Variation) |
| 12 | 672 784 C1 | GASKET, lubricating oil pump suction pipe elbow |
| 13 | 258 982 R11 | PLATE, oil pump suction pipe bottom |
| | 25 752 R1 | SCREW, hex-hd cap (3) |
| | 25 222 R1 | SCREW, hex-hd cap |
| | 27 616 R1 | WASHER, 1/4" hardened (4) |
| | 25 519 R1 | NUT |
| 14 | | (See Individual Engine Variation) |
| 15 | | (See Individual Engine Variation) |
| 16 | | (See Individual Engine Variation) |
| 17 | | (See Individual Engine Variation) |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **OIL GAUGE, FILLER PIPE, LUBRICATING SUCTION PIPING AND RELATED PARTS — Continued** |
| | | **ENGINE VARIATIONS** |
| | | **(TD-25C)** |
| 1 | 310 121 R91 | GAUGE, oil level |
| 2 | 601 238 C11 | SLEEVE, oil level gauge |
| 5 | 680 349 C1 | ELBOW, oil filler |
| | 277 232 R1 | SCREW, hex-hd cap (2) |
| | 24 840 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (3) |
| 10 | 279 853 R11 | PIPE, lubricating oil scavenging pump suction |
| | 24 839 R1 | SCREW, hex-hd cap (3) |
| | 25 896 R1 | WASHER, hardened (3) |
| 11 | 316 319 R21 | PIPE, lubricating oil pump suction (Front sump) |
| | 24 839 R1 | SCREW, hex-hd cap |
| | 24 621 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, 3/8" hardened (3) |
| 16 | 263 548 R1 | CLIP, oil level gauge sleeve |
| | 26 310 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (2) |
| | 25 522 R1 | NUT |
| 17 | 686 836 C1 | ANGLE, clip |
| | 26 311 R1 | SCREW, hex-hd cap (For Piston Cooling Jet Assembly) |
| | | **(H-100C and D-120C)** |
| 1 | 307 932 R91 | GAUGE, oil level |
| 2 | 601 242 C11 | SLEEVE, oil level gauge |
| 5 | 332 699 R91 | ELBOW, oil filler |
| | 24 840 R1 | SCREW, hex-hd cap |
| | 277 232 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (3) |
| 11 | 683 228 C91 | PIPE, lubricating oil pump suction (Front sump) |
| | 20 834 R1 | SCREW, hex-hd cap |
| | 277 232 R1 | SCREW, hex-hd cap (3) |
| | 115 093 | WASHER, lock (2) |
| | | **(H-560)** |
| 1 | 307 932 R91 | GAUGE, oil level 11674 and below |
| 1 | 674 188 C91 | GAUGE, oil level 11675 and up |
| 2 | 601 242 C11 | SLEEVE, oil level gauge |
| 5 | 332 699 R91 | ELBOW, oil filler |
| | 24 840 R1 | SCREW, hex-hd cap |
| | 277 232 R11 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (3) |
| 10 | 279 853 R11 | PIPE, lubricating oil scavenging pump suction 11674 and below |
| | 20 634 R1 | SCREW, hex-hd cap (3) |
| | 103 321 | WASHER, 3/8" lock (3) |
| 11 | 316 319 R21 | PIPE, lubricating oil pump suction (Front sump) 11674 and below |
| 11 | 683 228 C91 | PIPE, lubricating oil pump suction (Front sump) 11675 and up |
| | 24 839 R1 | SCREW, hex-hd cap |
| | 24 621 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (3) |
| 14 | 674 422 C1 | BRACKET, suction pipe support 11675 and up |
| 15 | 683 243 C1 | SUPPORT, oil pump suction pipe 11675 and up |
| | 24 841 R1 | SCREW, hex-hd cap |
| | 25 522 R1 | NUT |
| | 25 896 R1 | WASHER, hardened |
| | 650 676 R1 | SPACER, pipe |
| | | **(330 and 340)** |
| 1 | 303 762 R91 | GAUGE, oil level |
| 2 | 701 328 C1 | SLEEVE, oil level gauge |
| 5 | 701 198 C91 | ELBOW, oil filler |
| | 24 586 R1 | SCREW, hex-hd cap (2) |
| | 277 232 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened |
| 11 | 316 319 R21 | PIPE, lubrication oil pump suction (Front sump) |
| | 24 839 R1 | SCREW, hex-hd cap |
| | 24 621 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (3) |

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS

## MANIFOLD 14

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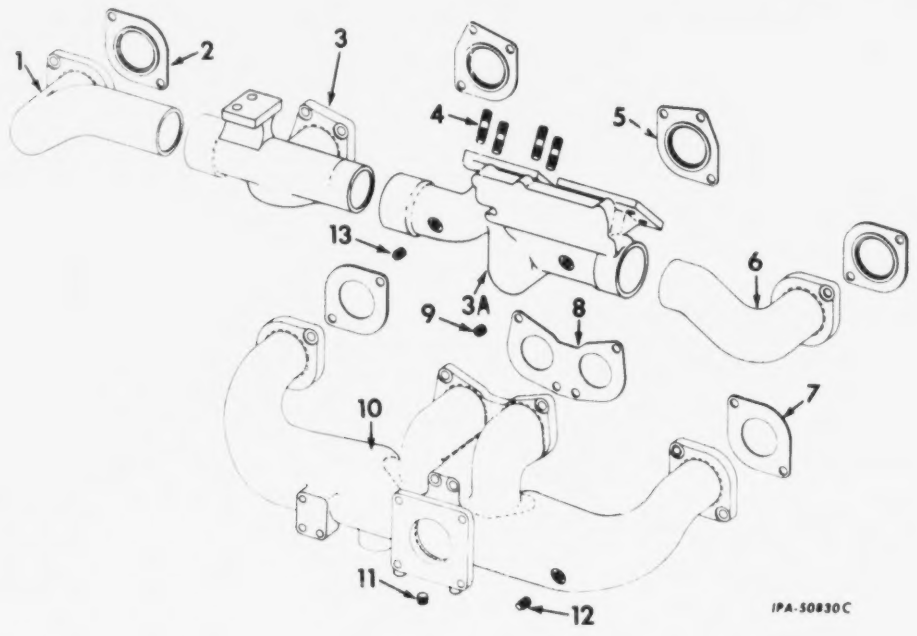
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

INTAKE AND EXHAUST MANIFOLD




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | 303 453 R1 | MANIFOLD, exhaust rear |
| | 25 527 R1 | NUT, exhaust manifold stud (2) |
| | 25 546 R1 | WASHER, hardened (2) |
| 2 | 304 063 R1 | GASKET, exhaust manifold front and rear (2) |
| 3 | 323 990 R1 | MANIFOLD, rear intermediate exhaust |
| | 25 527 R1 | NUT, exhaust manifold stud (3) |
| | 25 546 R1 | WASHER, hardened (3) |
| 3A | 332 407 R93 | MANIFOLD w/PLUG, 444 577 and PLUG, 444 692, front intermediate exhaust |
| | 25 527 R1 | NUT, exhaust manifold stud (3) |
| | 25 546 R1 | WASHER, hardened (3) |
| 4 | 256 333 R1 | STUD, exhaust outlet (4) |
| 5 | 304 064 R1 | GASKET, exhaust manifold intermediate (2) |
| 6 | 303 451 R1 | MANIFOLD, exhaust front |
| | 25 527 R1 | NUT, exhaust manifold stud (2) |
| | 25 546 R1 | WASHER, hardened (2) |
| 7 | 277 976 R1 | GASKET, intake manifold end (2) |
| 8 | 277 975 R1 | GASKET, intake manifold center |
| 9 | 444 577 | PLUG, 1/4" sq-hd pipe |
| 10 | 701 199 C91 | MANIFOLD w/PLUG, 444 576 and PLUG, 445 684, intake |
| | 25 527 R1 | NUT (2) |
| | 24 863 R1 | SCREW, hex-hd cap (4) |
| | 25 298 R1 | SCREW, hex-hd cap (2) |
| | 25 546 R1 | WASHER, hardened (8) |
| 11 | 444 576 | PLUG, 1/4" sq-soc pipe |
| 12 | 445 684 | PLUG, 1/8" sq-hd pipe |
| 13 | 444 692 | PLUG, 1/4" hex-soc pipe |
| | 320 110 R1 | BRACKET, intake manifold support |
| | 24 840 R1 | SCREW, 1" long hex-hd cap (2) |
| | 140 483 H | SCREW, 1-1/4" long hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (4) |
| | 25 896 R1 | WASHER, flat |



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REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS



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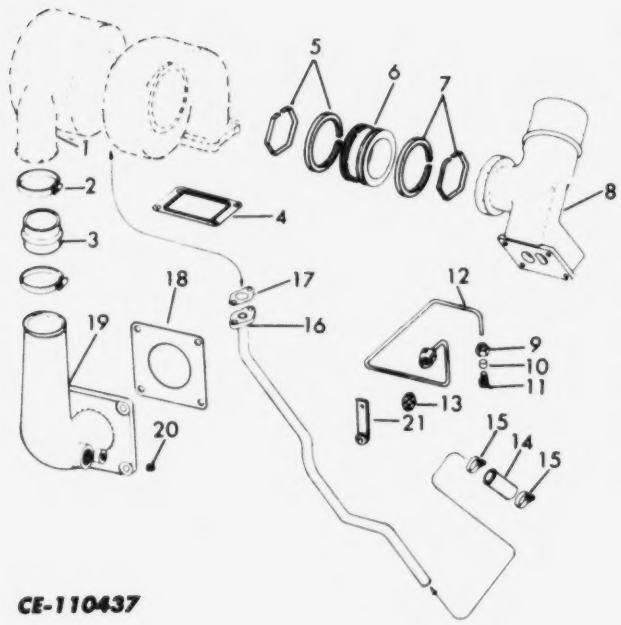
# TURBOCHARGER

TURBOCHARGER PIPING AND RELATED PARTS
(TD-25C, 560, H-100C and D-120C)




CE-110437

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | TURBOCHARGER ASSEMBLY (Refer to "Turbocharger") |
| | 253 665 R1 | NUT, mounting (4) |
| 2 | 397 257 R1 | CLAMP, discharge air hose (2) |
| 3 | | (See Individual Engine Variation) |
| 4 | 670 354 C1 | GASKET, turbocharger |
| 5 | | (See Individual Engine Variation) |
| 6 | | (See Individual Engine Variation) |
| 7 | | (See Individual Engine Variation) |
| 8 | 674 003 C2 | ELBOW, turbocharger exhaust |
| | 253 665 R1 | NUT (2) |
| | 140 483 H | SCREW, 1-1/4" long hex-hd cap (+) (2) |
| | 25 498 R1 | SCREW, 1-5/8" long hex-hd cap (Intercooler front support) (%) (2) |
| | 25 705 R1 | SCREW, 1-3/4" long hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (4) |
| | PO-10532 | WASHER, 13/32" (Intercooler front support) (%) (2) |
| 9 | 277 738 R1 | NUT |
| 10 | 277 737 R1 | SLEEVE |
| 11 | 277 736 R1 | CONNECTOR |
| 12 | | (See Individual Engine Variation) |
| 13 | | (See Individual Engine Variation) |
| 14 | 341 003 R1 | HOSE, turbocharger oil outlet connecting |
| 15 | 274 086 R91 | CLAMP, turbocharger oil outlet connecting hose (2) |
| 16 | | (See Individual Engine Variation) |
| 17 | | (See Individual Engine Variation) |
| 18 | | (See Individual Engine Variation) |
| 19 | | (See Individual Engine Variation) |
| 20 | | (See Individual Engine Variation) |
| 21 | 674 750 C1 | SUPPORT, turbocharger oil inlet tube clip (At intake manifold) |
| | 311 500 R1 | CLIP, turbocharger oil inlet tube (At breather pipe flange) |
| | 24 839 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened |
| | 25 522 R1 | NUT |

## ENGINE VARIATIONS

### (TD-25C)

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 3 | 670 353 C2 | HOSE, turbocharger air discharge |
| 5 | 702 019 C1 | SEAL w/RING, turbocharger exhaust sleeve |
| 6 | 674 004 C1 | SLEEVE, turbocharger exhaust |
| 7 | 680 956 C1 | SEAL w/RING, turbocharger exhaust sleeve |
| 12 | 701 207 C1 | TUBE w/FLANGE, turbocharger oil inlet |
| | 140 483 H | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 13 | 253 660 R1 | GASKET, turbocharger oil inlet tube flange |

(+) – For H-100C and D-120C.
(%) – For TD-25C and H-560.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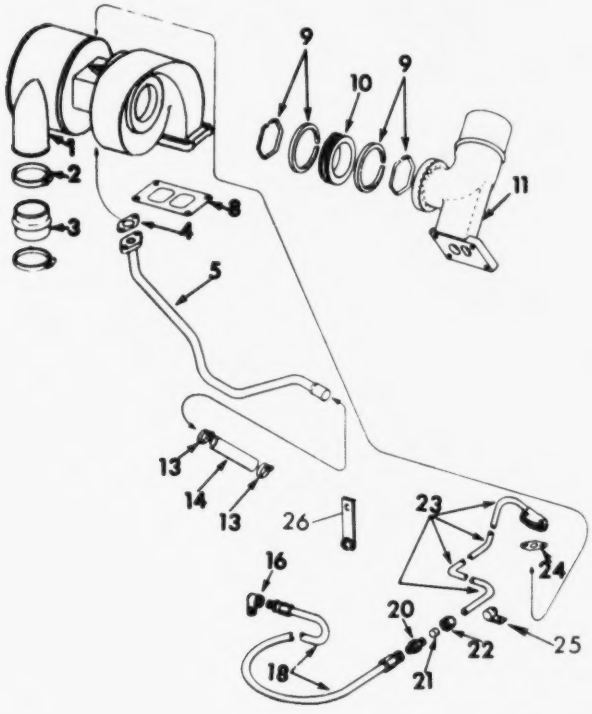
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **TURBOCHARGER PIPING AND RELATED PARTS – Continued (TD-25C, 560, H-100C and D-120C)** |
| | | **ENGINE VARIATIONS – Continued** |
| | | **(TD-25C – Continued)** |
| 16 | 680 393 C1 | TUBE w/FLANGE, turbocharger oil outlet |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 895 R1 | WASHER, hardened (2) |
| 17 | 253 664 R2 | GASKET, turbocharger oil outlet tube flange |
| | | **(560)** |
| 3 | 303 831 R2 | HOSE, turbocharger air discharge |
| 5 | 680 956 C1 | SEAL w/RING, turbocharger exhaust sleeve |
| 6 | 349 406 R1 | SLEEVE, turbocharger exhaust |
| 7 | 680 956 C1 | SEAL w/RING, turbocharger exhaust sleeve |
| 12 | 701 329 C1 | TUBE, turbocharger oil inlet |
| | 25 496 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| | 311 500 R1 | CLIP, tube |
| 13 | 618 560 C1 | GASKET, turbocharger oil inlet tube flange |
| 16 | 701 205 C1 | TUBE, turbocharger oil outlet |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened |
| 17 | 670 355 C1 | GASKET, turbocharger oil outlet flange |
| | | **(H-100C and D-120C)** |
| 3 | 303 831 R2 | HOSE, turbocharger air discharge |
| 5 | 680 956 C1 | SEAL w/RING, turbocharger exhaust sleeve |
| 6 | 674 004 C1 | SLEEVE, turbocharger exhaust |
| 7 | 702 019 C1 | SEAL, turbocharger exhaust sleeve |
| 12 | 701 207 C1 | TUBE, turbocharger oil inlet |
| | 25 497 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| | 311 500 R1 | CLIP, tube |
| 13 | 253 660 R1 | GASKET, turbocharger oil inlet tube flange |
| 16 | 680 393 C1 | TUBE, turbocharger oil outlet |
| | 24 840 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened (2) |
| 17 | 253 664 R2 | GASKET, turbocharger oil outlet flange |
| 18 | 303 458 R1 | GASKET, air discharge elbow |
| 19 | 320 115 R1 | ELBOW, turbocharger air discharge |
| | 25 525 R1 | NUT (4) |
| | 21 086 R1 | SCREW, hex-hd cap (4) |
| | 26 272 R1 | WASHER, hardened (4) |
| 20 | 444 577 | PLUG, 1/4" sq-hd pipe |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | TURBOCHARGER AND RELATED PARTS (330 and 340) |




CE-110425

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| 1 | | TURBOCHARGER ASSEMBLY (Refer to "Turbocharger") |
| 2 | 397 257 R1 | CLAMP, discharge air hose (2) |
| 3 | 303 831 R2 | HOSE, turbocharger air discharge |
| 4 | 670 355 C1 | GASKET, turbocharger oil outlet tube flange |
| 5 | 701 205 C1 | TUBE, turbocharger oil outlet |
| | 24 840 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| 8 | 670 354 C1 | GASKET, turbocharger |
| 9 | 680 956 C1 | SLEEVE, turbocharger exhaust (2) |
| 10 | 349 406 R1 | SLEEVE, turbocharger exhaust |
| 11 | 674 003 C1 | ELBOW, turbocharger exhaust |
| | 253 665 R1 | NUT (2) |
| | 24 913 R1 | SCREW, hex-hd cap (2) |
| | 103 321 | WASHER, lock (4) |
| 13 | 274 086 R91 | CLAMP, turbocharger oil outlet connecting hose (2) |
| 14 | 341 003 R1 | HOSE, turbocharger oil outlet connecting |
| 16 | 120 063 | ELBOW, 3/8 x 90° street |
| 18 | 343 616 R91 | HOSE w/FITTING, turbocharger oil inlet (HOSE, 3/8"ID x 29" long w/FITTINGS) |
| 20 | 317 939 R1 | ADAPTER, 1/2" |
| 21 | 277 737 R1 | SLEEVE, 1/2" coupling |
| 22 | 277 738 R1 | NUT, 1/2" |
| 23 | 701 329 C1 | TUBE, turbocharger oil inlet |
| | 25 496 R1 | SCREW, hex-hd cap (2) |
| | 25 896 R1 | WASHER, hardened (2) |
| | 311 500 R1 | CLIP |
| 24 | 618 560 C1 | GASKET, turbocharger oil inlet tube flange |
| 25 | 311 500 R1 | CLIP, turbocharger oil inlet support |
| 26 | 674 750 C1 | SUPPORT, turbocharger oil inlet tube clip |
| | 24 839 R1 | SCREW, hex-hd cap |
| | 25 522 R1 | NUT, hex |
| | 25 896 R1 | WASHER, hardened |



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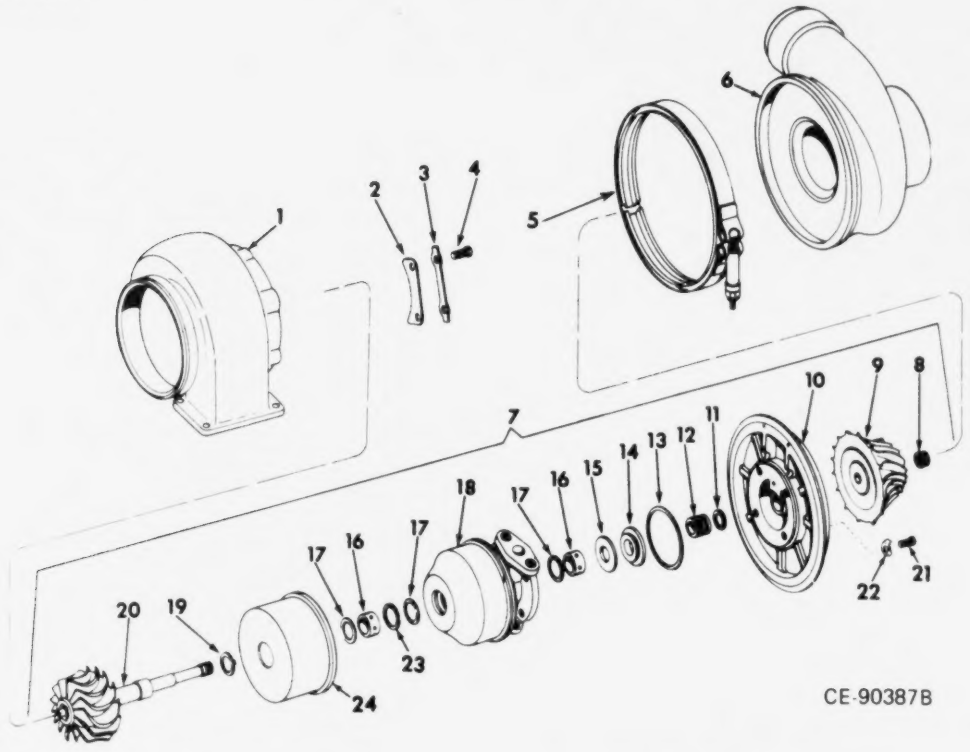
# TURBOCHARGER

TURBOCHARGER
(Airsearch Model THO8A-61)
(330, 340 and 560)

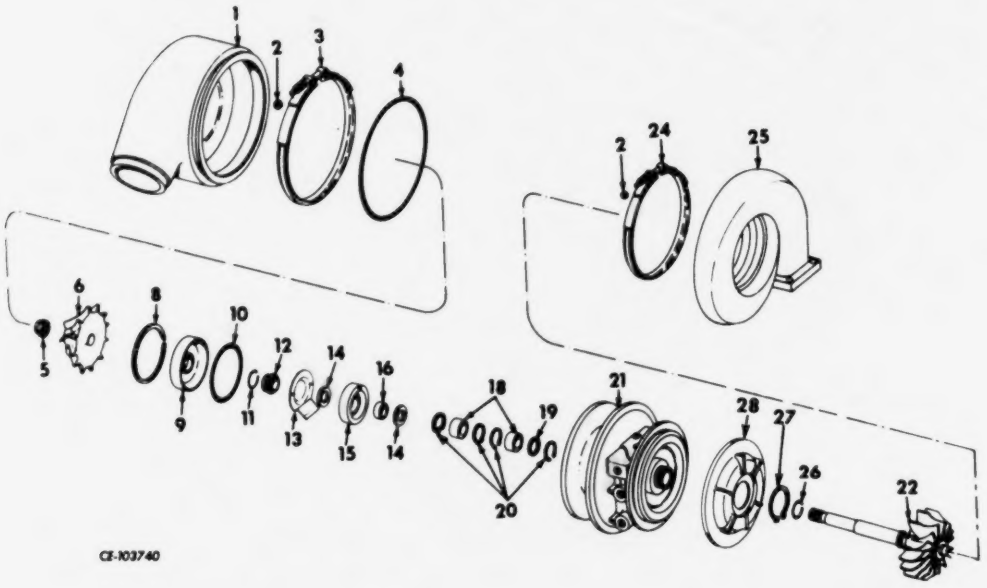



CE-90387B

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 681 441 C92 | TURBOCHARGER ASSY. (Consists of the following parts - |
| 1 | 680 309 C1 | HOUSING, turbine |
| 2 | 619 461 C1 | CLAMP, housing (3) |
| 3 | 619 460 C1 | PLATE, lock (3) |
| 4 | 619 459 C1 | SCREW, hex-hd cap (6) |
| 5 | 625 692 C91 | CLAMP w/NUT, V-bank |
| 6 | 681 476 C2 | HOUSING, compressor |
| 7 | 681 479 C92 | CORE ASSY., housing |
| 8 | 338 530 R1 | NUT, impeller lock |
| 9 | 681 477 C2 | WHEEL, impeller |
| 10 | 681 478 C1 | PLATE, back |
| 11 | 321 379 R1 | RING, piston seal |
| 12 | 631 075 C1 | SPACER, thrust |
| 13 | 619 466 C1 | RING, plate seal |
| 14 | 619 467 C1 | COLLAR, thrust |
| 15 | 688 703 C1 | BEARING, in board thrust |
| 16 | 684 005 C1 | BEARING, shaft (2) |
| 17 | 21 225 R1 | RING, retaining (3) |
| 18 | 702 978 C1 | HOUSING, rotating |
| 19 | 619 468 C1 | RING, piston seal |
| 20 | 702 976 C1 | WHEEL and SHAFT, turbine |
| 21 | 25 484 R1 | SCREW, 1/4 x 1-1/8" hex-hd cap (4) |
| 22 | 625 676 C1 | PLATE, bolt lock (4) |
| 23 | 619 470 C1 | WASHER, bearing (2) |
| 24 | 619 463 C1 | SHROUD, turbine wheel |
| | 681 480 C92 | CORE ASSY. (Remanufactured) (Individual component parts making up remanufactured CORE ASSYS. are not serviceable by themselves). |

# TURBOCHARGER

TURBOCHARGER
(Schwitzer)(Model 4LF-754)
(TD-25C, H-100C and D-120C)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 680 436 C93 | TURBOCHARGER ASSY. (Consists of the following parts - |
| 1 | 630 681 C1 | COVER, turbocharger compressor |
| 2 | | NUT (Not furnished separately) |
| 3 | 615 328 C91 | CLAMP, compressor cover |
| 4 | 615 331 C1 | RING, compressor cover sealing |
| 5 | 615 340 C1 | LOCKNUT, compressor wheel |
| 6 | 630 683 C3 | WHEEL, compressor |
| 8 | 615 332 C1 | RING, insert snap |
| 9 | 615 333 C1 | INSERT, flinger sleeve |
| 10 | 687 132 C1 | "O" RING, (Replaces 615 334 C1) (Insert) |
| 11 | 313 156 R1 | RING, piston |
| 12 | 615 342 C1 | SLEEVE, flinger |
| 13 | 615 335 C1 | DEFLECTOR, oil |
| 14 | 615 343 C1 | RING, thrust (2) |
| 15 | 630 685 C1 | BEARING, thrust |
| 16 | 615 344 C1 | SLEEVE, spacer |
| 18 | 615 338 C1 | BUSHING, housing (2) |
| 19 | 615 337 C1 | SLEEVE, oil control |
| 20 | 313 147 R1 | RING, snap (4) |
| 21 | 684 946 C1 | HOUSING, bearing (Together w/ PISTON RING, 619 819 C1, will work for HOUSING, 630 687 C1) |
| 22 | 630 686 C1 | WHEEL and SHAFT, turbine |
| 24 | 615 330 C91 | CLAMP, housing |
| 25 | 630 682 C1 | HOUSING, turbine |
| 26 | 615 819 C1 | RING, turbine piston |
| 27 | 457 505 R1 | RING, insert snap |
| 28 | 630 688 C1 | PLATE, turbine back |
| | 630 690 C93 | CORE ASSY., turbocharger (Remanufactured) (Individual components making up remanufactured core assemblies are not serviceable by themselves) |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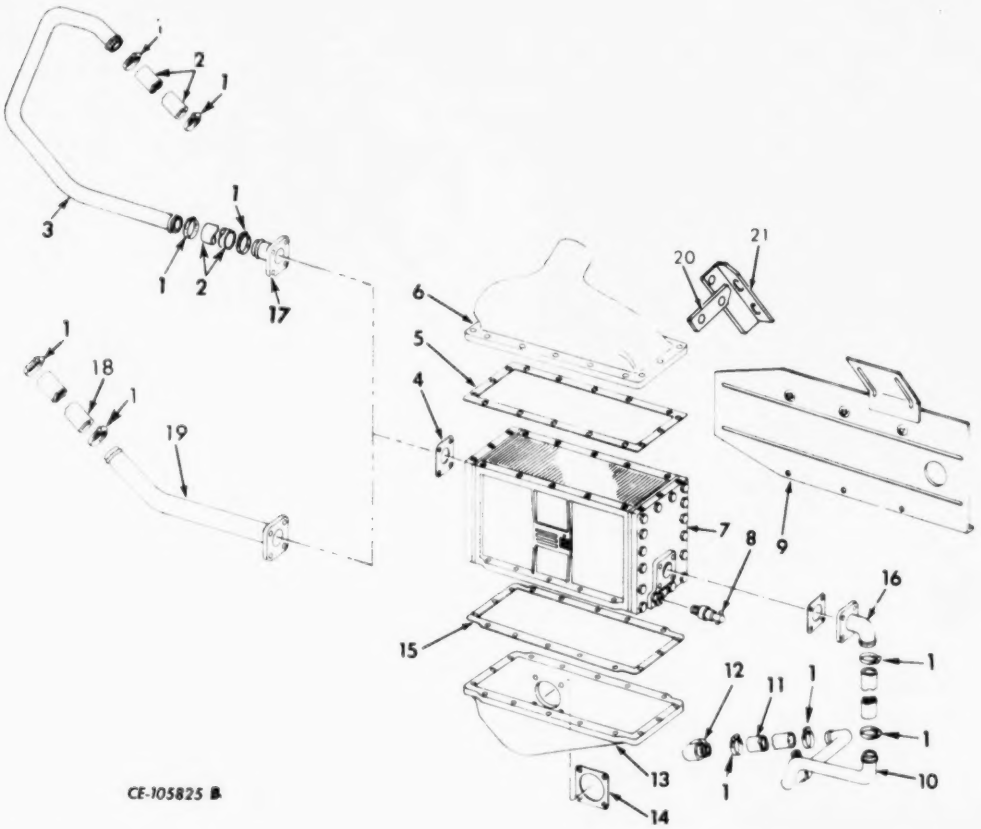
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

TURBOCHARGER – Continued
(Schwitzer) (Model 4LF-754)
(TD-25C, H-100C and D-120C)

| | | | |
|---|---|---|---|
| 630 689 C93 | CORE ASSY., turbocharger replaceable | | |
| | (Composed of - | | |
| | 1 | BEARING | 630 685 C1 |
| | 2 | BUSHING | 615 338 C1 |
| | 1 | DEFLECTOR | 615 335 C1 |
| | 1 | HOUSING | 684 946 C1 |
| | 1 | INSERT | 615 333 C1 |
| | 1 | LOCKNUT | 615 340 C1 |
| | 1 | "O" RING | 615 334 C1 |
| | 1 | PLATE | 630 688 C1 |
| | 1 | RING | 457 505 R1 |
| | 1 | RING | 615 331 C1 |
| | 4 | RING | 313 147 R1 |
| | 1 | RING | 615 332 C1 |
| | 1 | RING | 313 156 R1 |
| | 1 | RING | 619 819 C1 |
| | 2 | RING | 615 343 C1 |
| | 1 | SLEEVE | 615 344 C1 |
| | 1 | SLEEVE | 615 342 C1 |
| | 1 | SLEEVE | 615 337 C1 |
| | 1 | WHEEL | 630 683 C2 |
| | 1 | WHEEL and SHAFT | 630 686 C1 ) |

| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

INTERCOOLER, PIPING AND RELATED PARTS
(TD-25C, 330, 340, and 560)




| | | | | | |
|---|---|---|---|---|---|
| 1 | 274 086 R91 | CLAMP, hose (6) | 12 | 321 793 R1 | ELBOW, intercooler water inlet (In crankcase) |
| 2 | | (See Individual Engine Variation) | 13 | 701 213 C91 | ELBOW w/two STUDS, 260 870 R1 and PLUG, 445 751, intercooler air outlet |
| 3 | | (See Individual Engine Variation) | | 25 525 R1 | NUT (4) |
| 4 | 320 122 R1 | GASKET, intercooler tube water inlet and outlet flange (2) | | 25 654 R1 | SCREW, hex-hd cap (16) |
| | | | | 25 801 R1 | SCREW, hex-hd cap (2) |
| 5 | 670 361 C1 | GASKET, intercooler upper | | 27 326 R1 | WASHER, 5/16" hardened (16) |
| | | | | 26 272 R1 | WASHER, 7/16" hardened (6) |
| 6 | | (See Individual Engine Variation) | | 445 751 | PLUG, 1/2" soc-hd pipe |
| 7 | 684 295 C1 | INTERCOOLER | 14 | 303 458 R1 | GASKET, air outlet elbow to manifold |
| 8 | 9 872 T | VALVE, drain | 15 | 670 362 C1 | GASKET, intercooler lower |
| 9 | 701 212 C2 | SHIELD, intercooler heat | 16 | 701 210 C1 | ELBOW, intercooler water inlet |
| | 25 752 R1 | SCREW, hex-hd cap (6) | | 25 492 R1 | SCREW, hex-hd cap (4) |
| | 27 616 R1 | WASHER, hardened (6) | | 27 326 R1 | WASHER, hardened (4) |
| 10 | 701 209 C1 | PIPE, intercooler water inlet | 17 | | (See Individual Engine Variation) |
| 11 | 346 751 R1 | HOSE, 1 x 1-1/2 x 2-5/8" intercooler water inlet (2) | 18 | | (See Individual Engine Variation) |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **INTERCOOLER, PIPING AND RELATED PARTS Continued** (TD-25C, 330, 340 and 560) |
| 19 | | (See Individual Engine Variation) |
| 20 | 670 366 C1 | STRAP, intercooler support |
| | 23 776 D | SPACER |
| | 140 483 H | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, 3/8" lock |
| | 25 522 R1 | NUT |
| | 140 483 H | SCREW, hex-hd cap (At intercooler air inlet elbow) |
| | 25 896 R1 | WASHER, 3/8" lock (At intercooler air inlet elbow) |
| 21 | 670 365 C1 | SUPPORT, intercooler |
| | 321 792 R1 | CONNECTOR, intercooler water outlet hose (In rear water manifold) |
| | 343 750 R1 | FITTING, air compressor air inlet (In intercooler air outlet housing) |
| | 260 870 R1 | STUD (2) |
| | 24 619 R1 | SCREW, hex-hd cap (Intercooler front support) (2) |
| | PO-10532 | WASHER, 1-1/4 x 13/32 x 1/8" (2) |

## ENGINE VARIATIONS

### (330 and 340)

| | | |
|---|---|---|
| 6 | 670 374 C1 | ELBOW, intercooler air inlet |
| | 25 654 R1 | SCREW, hex-hd cap (16) |
| | 27 326 R1 | WASHER, hardened (16) |
| 18 | 320 463 R1 | HOSE, intercooler water outlet |
| 19 | 701 211 R91 | TUBE, intercooler water outlet |
| | 25 492 R1 | SCREW, hex-hd cap (4) |
| | 27 326 R1 | WASHER, hardened (4) |

### (TD-25C)

| | | |
|---|---|---|
| 2 | 346 751 R1 | HOSE, water outlet (2) |
| 3 | 670 735 C1 | TUBE, intercooler water outlet |
| 6 | 670 375 C1 | ELBOW, intercooler air inlet |
| | 25 654 R1 | SCREW, hex-hd cap |
| | 27 326 R1 | WASHER, hardened |
| 17 | 320 119 R91 | TUBE, intercooler water outlet |
| | 25 492 R1 | SCREW, hex-hd cap (4) |
| | 27 326 R1 | WASHER, hardened (4) |

### (560)

| | | |
|---|---|---|
| 2 | 346 751 R1 | HOSE, water outlet (2) |
| 3 | 670 735 C1 | TUBE, inercooler water outlet |
| 6 | 670 374 C1 | ELBOW, intercooler air inlet |
| | 25 654 R1 | SCREW, hex-hd cap (16) |
| | 27 326 R1 | WASHER, hardened (16) |
| 17 | 320 119 R91 | TUBE, intercooler water outlet |
| | 25 492 R1 | SCREW, hex-hd cap (4) |
| | 27 326 R1 | WASHER, hardened (4) |

REFER TO ALPHABETICAL INDEX
FOR COMPLETE LISTING OF PARTS



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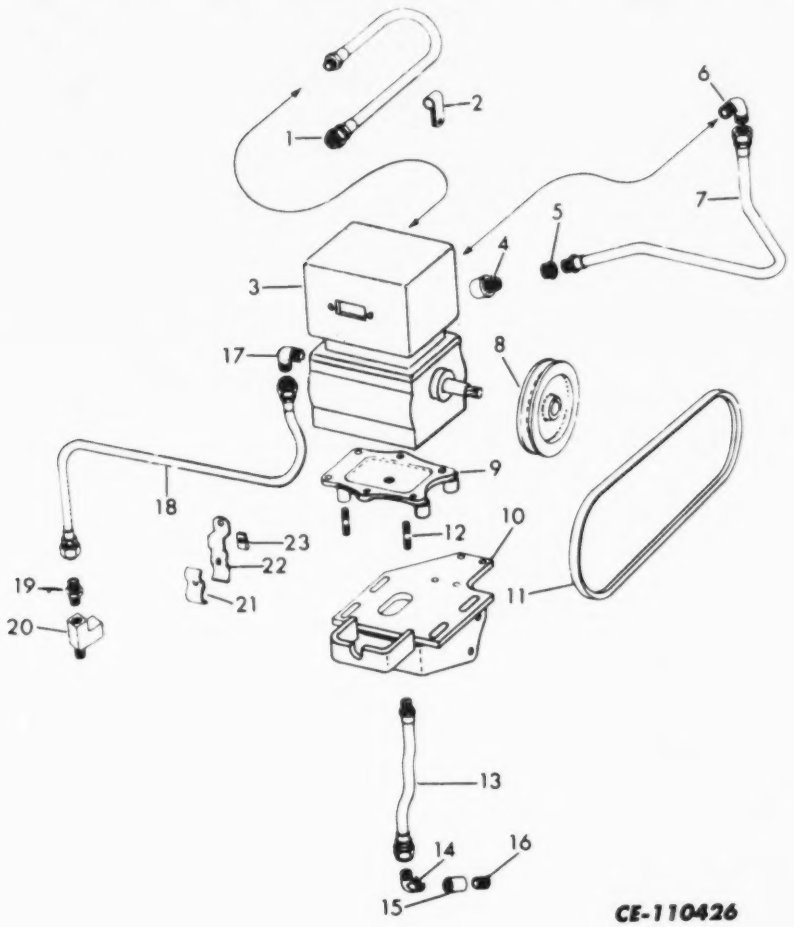
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIP. |
|---|---|---|---|---|---|

AIR COMPRESSOR PIPING AND RELATED PARTS
(H-100C, D-120C, 330 and 340)




| | | | | | |
|---|---|---|---|---|---|
| 1 | 324 527 R91 | HOSE w/FITTINGS, air compressor water outlet (HOSE, 1/2"ID x 19" long including FITTINGS) | 4 | 141 621 | ELBOW, street (In crankcase) |
| | 137 894 | ELBOW, 1/2" x 45° street | 5 | 144 042 | BUSHING, 3/4 x 1/2" reducing |
| 2 | 278 783 R1 | CLIP, air compressor water outlet hose | 6 | 300 892 R1 | ELBOW |
| | 20 834 R1 | SCREW, hex-hd cap | 7 | 333 831 R91 | HOSE w/FITTINGS, air compressor water inlet (HOSE, 1/2"ID x 37-1/2" long including FITTINGS) |
| | 103 321 | WASHER | | | |
| 3 | | (See Individual Engine Variation) | | | |



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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR COMPRESSOR PIPING AND RELATED PARTS – Continued (H-100C, D-120C, 330 and 340)** |
| 8 | | (See Individual Engine Variation) |
| 9 | | (See Individual Engine Variation) |
| 10 | | (See Individual Engine Variation) |
| 11 | | (See Individual Engine Variation) |
| 12 | | (See Individual Engine Variation) |
| 13 | | (See Individual Engine Variation) |
| 14 | | (See Individual Engine Variation) |
| 15 | | (See Individual Engine Variation) |
| 16 | | (See Individual Engine Variation) |
| 17 | | (See Individual Engine Variation) |
| 18 | 324 528 R91 | HOSE w/FITTINGS, air compressor lubricating oil inlet (HOSE, 1/4" ID x 32" long w/FITTINGS) |
| 19 | | (See Individual Engine Variation) |
| 20 | | (See Individual Engine Variation) |
| 21 | 279 830 R1 | CLAMP, air compressor hose (Short) (3) |
| 22 | 279 831 R1 | CLAMP, air compressor hose (Long) |
| 23 | 262 038 R1 | NUT (2) |
| | 114 354 | SCREW, fil hd. sl. machine (2) |
| | 141 539 | BUSHING, 1/4 x 1/8" reducer (In crankcase) |
| | 278 783 R1 | CLIP, air compressor water inlet hose |
| | 24 839 R1 | SCREW, hex-hd cap |
| | 25 896 R1 | WASHER, hardened |
| | | **ENGINE VARIATIONS** |
| | | **(330 and 340)** |
| 3 | | COMPRESSOR ASSY, air (See NOTE) |
| 6 | | ELBOW (See NOTE) |
| 8 | | PULLEY, air compressor (See NOTE) |
| 9 | | BASE, air compressor (See NOTE) |
| 10 | | PLATE, air compressor mounting (See NOTE) |
| 11 | | BELT, air compressor (See NOTE) |
| 12 | | STUD, air compressor (See NOTE) |
| 13 | | HOSE, air compressor lubricating oil outlet (See NOTE) |
| 14 | | ELBOW (See NOTE) |
| 15 | 187 396 | COUPLING, 3/8" pipe (On nipple) |
| 16 | 121 207 | NIPPLE, 1" close pipe (In crankcase) |
| 17 | | ELBOW (See NOTE) |
| 19 | 118 748 | CONNECTOR, 1/8 x 1/4" flared tube |
| 20 | 9 409 943 | TEE, 1/8" auto-internal-external-internal pipe |
| | 328 898 R1 | CLAMP, air compressor water inlet |
| | 343 750 R1 | FITTING, air compressor air inlet |
| | | 100C and D 120C) |
| 3 | | COMPRESSOR ASSY, air (Refer to "Air Compressor") |
| | 25 | NUT (6) |
| | | SCREW, hex-hd cap (6) |
| | | WASHER, hardened (6) |
| 6 | - 757 | ELBOW, 1/2" x 90° |
| 8 | 278 713 R1 | PULLEY, air compressor |
| | 551 658 R1 | WASHER |
| | 103 386 | PIN, cotter |
| 9 | 312 151 R11 | BASE w/four ST[illegible] 333 R1, air compressor |
| | 25 523 R1 | NUT (4) |
| | 25 896 R1 | WASHER, hardened (4) |
| | 115 093 | WASHER (4) |

NOTE: Refer to Chassis Parts Catalog.

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

AIR COMPRESSOR PIPING AND RELATED PARTS
Continued
(H-100C, D-120C, 330 and 340)

ENGINE VARIATIONS – Continued

(H-100C and D-120C – Continued)

| | | |
|---|---|---|
| 10 | 306 413 R11 | PLATE, air compressor mounting |
| | 25 526 R1 | NUT (2) |
| | 870 325 R1 | BOLT, 7/16" dia. (4) |
| | 25 687 R1 | BOLT, 1/2" dia. (2) |
| | 25 293 R1 | SCREW, hex-hd cap (2) |
| | 26 272 R1 | WASHER, 7/16" hardened |
| | 27 516 R1 | WASHER, 9/16" hardened (x) |
| | 26 272 R1 | WASHER, .469" flat (4) |
| | 115 314 | WASHER, 7/16" lock (4) |
| | 26 273 R1 | WASHER, 1/2" hardened (4) |
| | 306 415 R1 | WASHER, 17/32" flat (x) |
| | 306 416 R1 | SPACER, bolt (4) |
| 11 | 601 684 C1 | BELT, air compressor |
| 12 | 256 333 R1 | STUD, air compressor base (4) |
| 13 | 278 717 R91 | HOSE w/FITTINGS, air compressor lubricating oil outlet (HOSE, 1/8" ID x 15" long including FITTINGS) |
| 14 | 230 766 R1 | ELBOW, 45° |
| 17 | 118 753 | ELBOW, 1/4" x 90° (2) |
| | 230 766 R1 | ELBOW, 45° flared (In crankcase) |

(x) - As Required.



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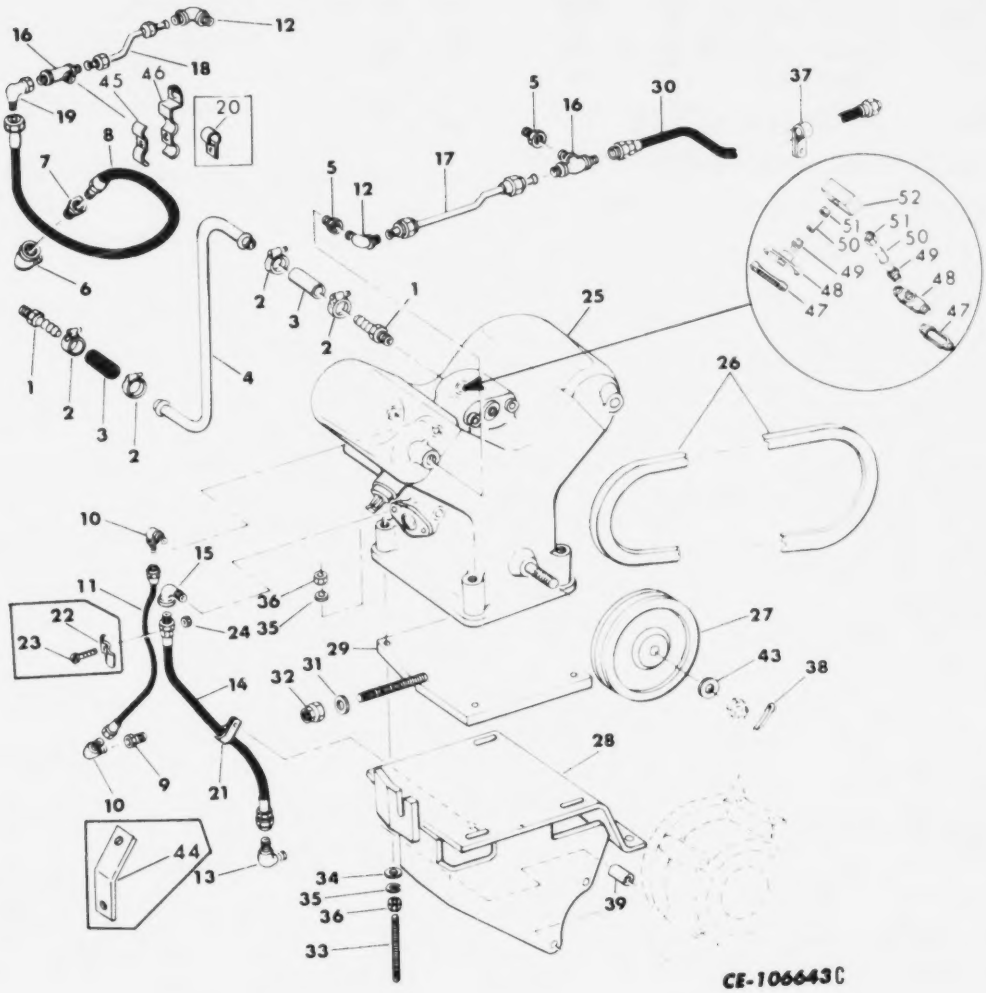
| REF. NO. | PART NUMBER | DESCRIPTION | REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|---|

## AIR COMPRESSOR PIPING (560)




| | | | | | |
|---|---|---|---|---|---|
| 1 | 343 750 R1 | FITTING, supply tube (In intercooler air outlet housing and compressor manifold) (2) | 6 | 141 621 | ELBOW, 3/4" x 90° street (In crankcase) |
| 2 | 122 316 R91 | CLAMP, hose (4) | 7 | 144 034 | BUSHING, 3/4 x 1/2" reducing |
| 3 | 612 472 C1 | HOSE, supply tube (2) | 8 | 672 884 C91 | HOSE, compressor water inlet |
| 4 | 672 562 C1 | TUBE, air supply 14594 and below | 9 | 141 539 | BUSHING, 1/4 x 1/8" reducing (In crankcase) |
| 4 | 689 050 C1 | TUBE, air supply 14595 and up | 10 | 118 753 | ELBOW, 7/16 x 90° flared tube (2) |
| 5 | 444 034 | BUSHING, 1/2 x 3/8" reducing (In compressor) (2) | 11 | 324 528 R91 | HOSE, compressor lub. oil inlet |
| | | | 12 | 265 024 R1 | ELBOW, flex, 90° (2) |
| | | | 13 | 230 766 R1 | ELBOW, flared tube, 3/4" x 90° |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR COMPRESSOR PIPING – Continued (For 560)** |
| 14 | 278 716 R91 | HOSE, compressor lub. oil outlet |
| 15 | 444 044 | ELBOW, 1/2"NPT x 90° (In compressor) |
| 16 | 118 762 | TEE, 3/8 x 3/4" - 16 x 3/4" - 16 (2) |
| 17 | 673 326 C91 | TUBE, compressor water outlet |
| 18 | 673 325 C91 | TUBE, compressor water inlet |
| 19 | 220 445 H1 | ELBOW, female swivel |
| 20 | 278 688 R1 | CLAMP, water inlet hose 14290 and Below |
| | 26 678 R1 | SCREW, hex-hd cap |
| | 25 520 R1 | NUT, hex |
| | 27 326 R1 | WASHER, hardened (2) |
| 21 | 278 688 R1 | CLIP, outlet hose |
| | 25 922 R1 | NUT, jam |
| 22 | 446 075 R91 | CLAMP, oil inlet hose (2) 14290 and Below |
| 23 | 114 354 | SCREW, 1/4 x 5/8" fil-hd-sltd-mach. 14290 and Below |
| 24 | 262 038 R1 | NUT |
| 25 | | COMPRESSOR ASSY., air (Refer to "Air Compressor") |
| 26 | 672 445 C1 | BELT, air compressor |
| 27 | 278 713 R1 | PULLEY, compressor |
| 28 | 672 446 C1 | BRACKET, air compressor mounting |
| | 70 427 R1 | SCREW, 1-1/4" long hex-hd cap (2) |
| | 25 821 R1 | SCREW, 6-1/2" long hex-hd cap (2) |
| | 26 272 R1 | WASHER, hardened (2) |
| | 25 546 R1 | WASHER, hardened (2) |
| 29 | 672 888 C1 | BASE, air compressor |
| 30 | 683 654 C91 | HOSE, compressor water outlet |
| 31 | 103 343 | WASHER, 17/32 x 1-1/16 x .095" plain |
| 32 | 18 594 R1 | LOCKNUT, 1/2" - 20 (Type 8) |
| 33 | 680 775 C1 | STUD (4) |
| 34 | 685 902 C1 | WASHER, hardened (4) |
| 35 | 25 555 R1 | WASHER, hardened (4) |
| 36 | 25 526 R1 | NUT, hex (8) |
| 37 | 279 830 R1 | CLAMP, water outlet hose |
| | 114 354 | SCREW |
| | 262 038 R1 | NUT |
| 38 | 193 376 | PIN, 3/32 x 1-1/2" cotter |
| 39 | 331 194 R1 | SPACER (2) |
| 43 | 551 658 R1 | WASHER, 25/32 x 1-1/4" x 22 gauge |
| | 306 415 R1 | WASHER, 17/32" x 1" x 22 gauge (x) — |
| | 446 229 | WASHER, 9/16" x 1-1/4" x 22 gauge (x) |
| 44 | 685 662 C1 | SUPPORT, air compressor hose 11621 to 14290 |
| | 137 894 | ELBOW, 1/2" x 45° street (In by-pass pipe) |
| | 444 788 | PLUG, 1/2" NPT pipe (In compressor) |
| | 702 093 C1 | STRAP, hose support |
| 45 | 279 830 R1 | CLAMP, air compressor hose (Short) 14291 and Up |
| 46 | 279 831 R1 | CLAMP, air compressor hose (Long) 14291 and Up |
| 47 | 634 867 C1 | GASKET, adapter plate 14595 and up |
| 48 | 689 115 C1 | PLATE, adapter 14595 and up |
| 49 | 871 445 C1 | CONNECTOR 14595 and up |
| 50 | 868 267 C1 | SLEEVE 14595 and up |
| 51 | 868 268 C1 | NUT 14595 and up |
| 52 | 689 093 C1 | ADAPTER, air inlet 14595 and up |

(x) – As Required.



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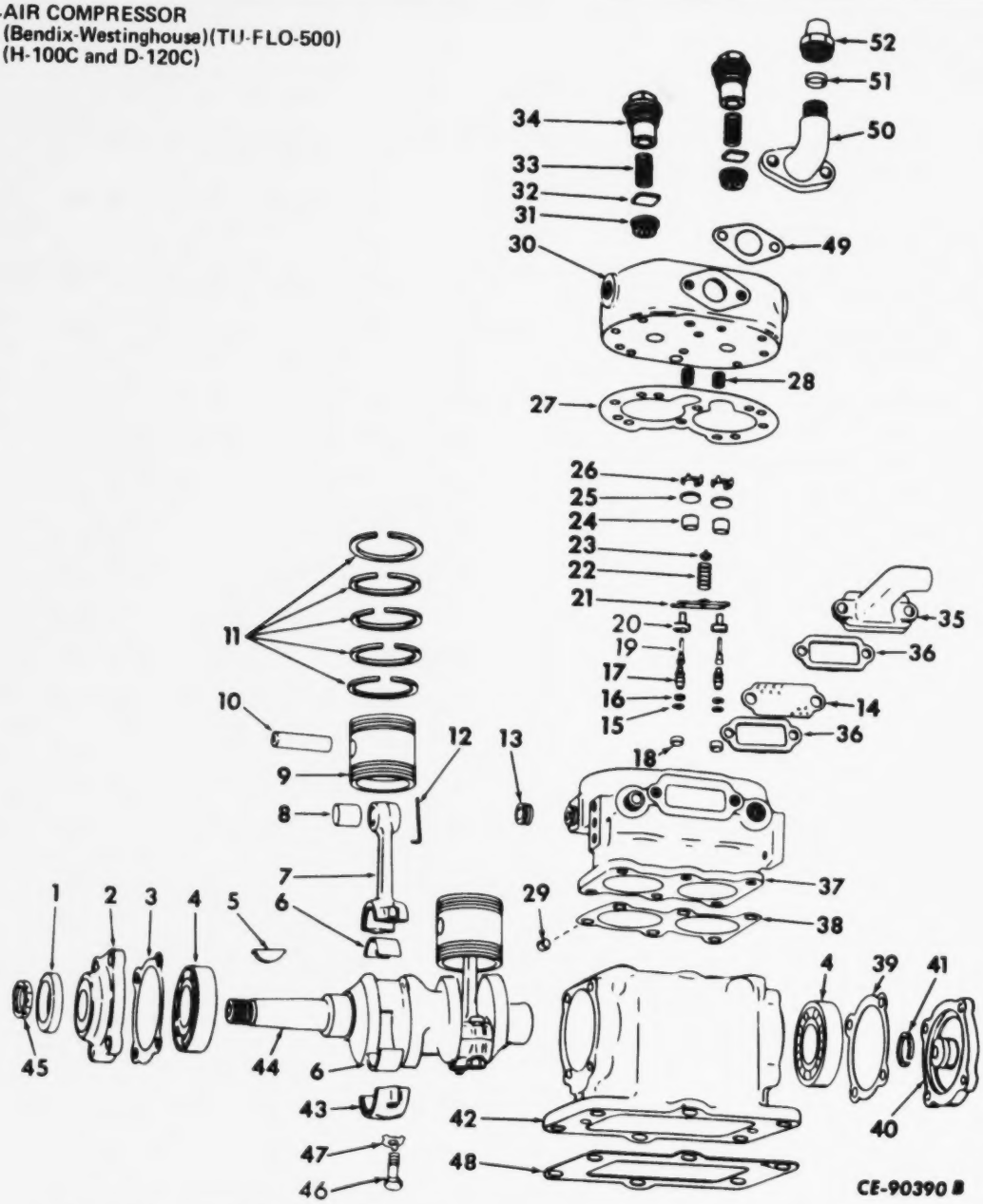
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

AIR COMPRESSOR
(Bendix-Westinghouse)(TU-FLO-500)
(H-100C and D-120C)




| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | 312 150 R91 | COMPRESSOR ASSEMBLY, air |
| | 25 525 R1 | NUT (6) |
| | 80 298 R1 | SCREW, hex-hd cap (6) |
| | 25 545 R1 | WASHER, lock (6) |
| | | (Consists of the following parts - |
| 1 | 328 528 C91 | OIL SEAL |
| 2 | 168 681 R1 | COVER, front |
| | 112 723 | WASHER, lock (4) |
| | 180 078 | SCREW, hex-hd cap (4) |
| 3 | 168 682 R1 | GASKET, front cover |
| 4 | 205 368 R91 | BEARING, ball (2) |
| 5 | 25 920 HO | KEY, hi-pro crankshaft |
| 6 | 228 668 R1 | INSERT, bearing (Standard) (4) |
| 6 | 228 669 R1 | INSERT, bearing (.010" undersize) (x) |
| 6 | 228 670 R1 | INSERT, bearing (.020" undersize) (x) |
| 6 | 228 671 R1 | INSERT, bearing (.030" undersize) (x) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| AIR COMPRESSOR – Continued (Bendix-Westinghouse) (TU-FLO-500) (H-100C and D-120C) | | |
| 7 | 228 684 R91 | ROD w/CAP, two BOLT, 208 495 R1 and BUSHING, 228 673 R1, connecting (2) |
| 8 | 228 673 R1 | BUSHING, wrist pin (2) |
| 9 | 302 032 R11 | PISTON and PIN, wrist set (Standard) (2) |
| 9 | 302 033 R11 | PISTON and PIN, wrist, set (.010" oversize) (2) |
| 9 | 302 034 R11 | PISTON and PIN, wrist, set (.020" oversize) (2) |
| 9 | 302 035 R11 | PISTON and PIN, wrist, set (.030" oversize) (2) |
| 10 | 302 119 R1 | PIN, wrist (.005" oversize) (x) |
| 11 | | RING, piston (Standard) (Order RING SET, 302 036 R91) (†) (6) |
| 11 | | RING, piston (.010" oversize) (Order RING SET, 302 037 R91) (†) (x) |
| 11 | | RING, piston (.020" oversize) (Order RING SET, 302 038 R91) (†) (x) |
| 11 | | RING, piston (.030" oversize (Order RING SET, 302 039 R91) (†) (x) |
| 11 | | RING, piston (Standard) (Order RING SET, 302 036 R91) (††) (x) |
| 11 | | RING, piston (.010" oversize) (Order RING SET, 302 037 R91) (††) (x) |
| 11 | | RING, piston (.020" oversize) (Order RING SET, 302 038 R91) (††) (x) |
| 11 | | RING, piston (.030" oversize) (Order RING SET, 302 039 R91) (††) (x) |
| 12 | 302 120 R1 | WIRE, wrist pin locking (2) |
| 13 | 444 691 | PLUG, hex-soc-hd |
| 14 | 307 808 R1 | PLATE, inlet elbow strainer |
| 15 | 182 077 R1 | GROMMET |
| 16 | 182 078 R1 | RING, spiral back-up |
| 17 | | PISTON, unloader (Order KIT, 168 684 R91) |
| 18 | | BUSHING (Order BODY ASSY., 202 199 R11) |
| 19 | | STOP, unloader cup (Order KIT, 168 684 R91) |
| 20 | | CUP, unloader (Order KIT, 168 684 R91) |
| 21 | | SADDLE, unloader spring (Order KIT, 168 684 R91) |
| 22 | | SPRING, unloader (Order KIT, 168 684 R91) |
| 23 | | SEAT, unloader spring (Order KIT, 168 684 R91) |
| 24 | | SEAT, inlet valve (Order BODY ASSY., 202 199 R11) |
| 25 | 302 041 R1 | VALVE, inlet (2) |
| 26 | 202 205 R2 | GUIDE, inlet valve (2) |
| 27 | 202 204 R1 | GASKET, cylinder head |
| 28 | 302 042 R1 | SPRING, inlet valve (2) |
| 29 | 444 698 | PLUG, hex-soc-hd (6) |
| 30 | 419 426 C91 | HEAD ASSEMBLY, cylinder (Includes Ref. Nos. 31 thru 34) |
| | 288 188 C1 | SCREW, hex-hd cap (10) |
| 31 | 182 401 R1 | SEAT, discharge valve (2) |
| 32 | 302 106 R1 | VALVE, discharge (2) |
| 33 | 142 374 H | SPRING, discharge valve (2) |
| 34 | 302 107 R1 | NUT, discharge valve cap (2) |
| 35 | 301 185 R1 | ELBOW, inlet |
| | 180 078 | SCREW, hex-hd cap (2) |
| | 112 723 | WASHER, lock (2) |
| 36 | 302 044 R1 | GASKET, inlet elbow (2) |
| 37 | 202 199 R11 | BODY ASSEMBLY, cylinder block (Includes Ref. Nos. 18 and 24) |
| | 180 122 | SCREW, hex-hd cap (6) |
| | 110 730 | WASHER, lock (6) |
| 38 | 302 031 R1 | GASKET, cylinder block |
| 39 | 168 683 R1 | GASKET, rear cover |
| 40 | 173 779 H1 | COVER, rear |
| | 180 078 | SCREW, hex-hd cap (4) |
| | 112 723 | WASHER, lock (4) |
| 41 | 38 882 DM | RING, oil seal |
| 42 | 312 153 R1 | CRANKCASE |

(x) - As Required.
(†) - For narrow pistons.
(††) - For wide pistons.



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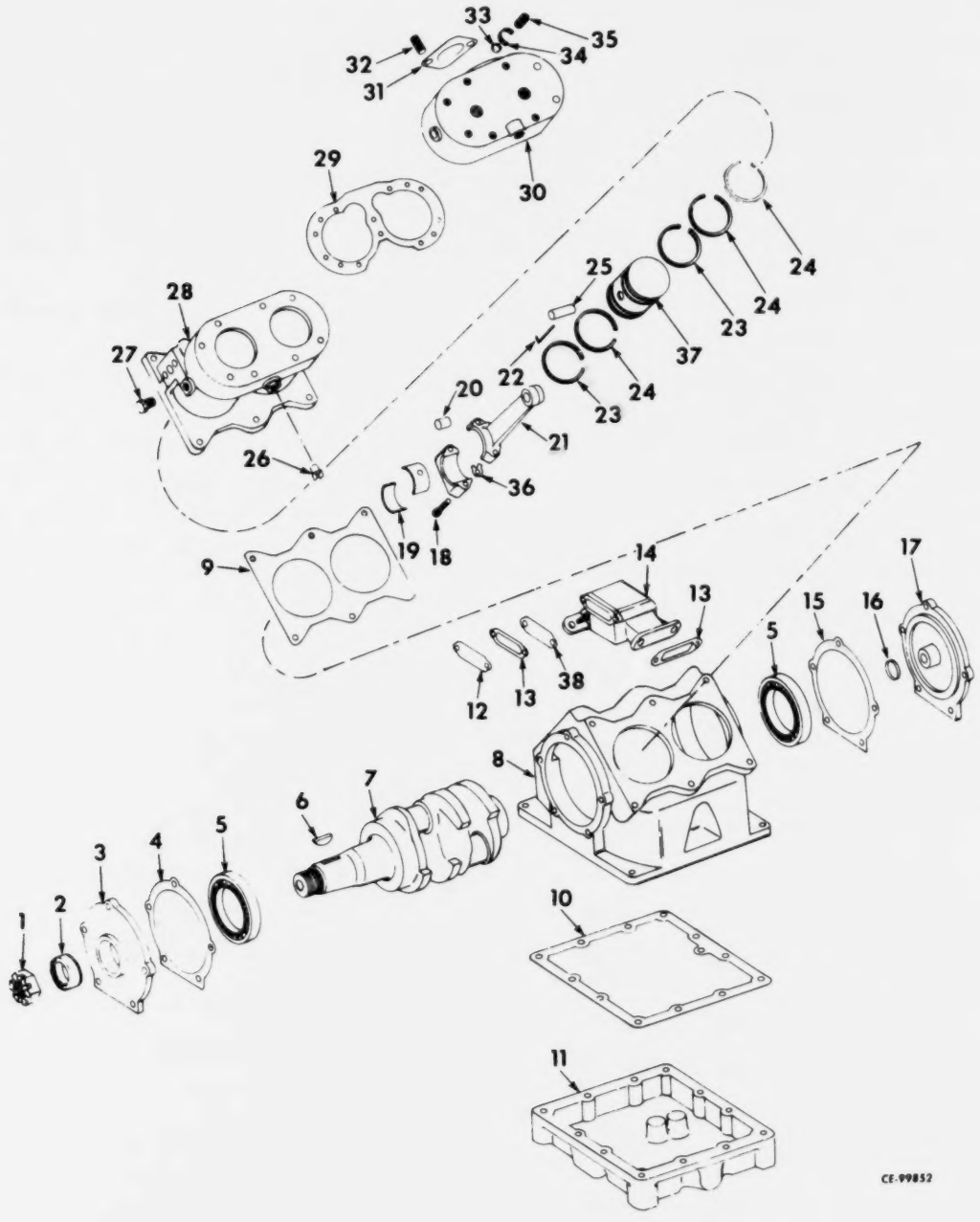
| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| | | **AIR COMPRESSOR – Continued (Bendix-Westinghouse)(TU-FLO-500) (H-100C and D-120C)** |
| 43 | | CAP, connecting rod (Order ROD, 228 684 R91) |
| 44 | 167 821 R1 | CRANKSHAFT |
| 45 | 136 778 R1 | NUT, crankshaft |
| 46 | 208 495 R1 | BOLT, connecting rod (4) |
| 47 | 228 675 R1 | WASHER, connecting rod bolt lock (4) |
| 48 | 313 354 R2 | GASKET, flange |
| 49 | 92 474 H | GASKET, discharge fitting |
| 50 | 301 476 R1 | BODY, discharge fitting |
| | 143 416 | NUT (2) |
| | 278 969 R1 | STUD, discharge fitting (2) |
| | 112 723 | WASHER, lock (2) |
| 51 | 55 896 R1 | SLEEVE, discharge fitting |
| 52 | 132 559 R1 | NUT, discharge fitting |
| | 168 684 R91 | KIT, unloader piston repair (x) |
| | 302 036 R91 | RING SET, piston (Standard) (Consists of ten RINGS) |
| | 302 037 R91 | RING SET, piston (.010" oversize) (Consists of ten RINGS) |
| | 302 038 R91 | RING SET, piston (.020" oversize) (Consists of ten RINGS) |
| | 302 039 R91 | RING SET, piston (.030" oversize) (Consists of ten RINGS) |

| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|

(x) - As Required.

**AIR COMPRESSOR**
**(Bendix-Westinghouse)(TU-FLO-1000)**
**(For 560)**





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| REF. NO. | PART NUMBER | DESCRIPTION |
|---|---|---|
| **AIR COMPRESSOR** (Bendix-Westinghouse) (For 560) | | **Continued** (TU-FLO-1000) |
| A | 672 444 C92 | COMPRESSOR ASSEMBLY, air (Order the following parts - 1 COMPRESSOR, air 689 127 C91; 1 ADAPTER 689 093 C1; 2 CONNECTOR 871 445 C1; 2 GASKET 634 867 C1; 2 NUT 868 268 C1; 2 PLATE 689 115 C1; 2 SCREW 25 492 C1; 2 SLEEVE 868 267 C1; 1 TUBE 689 050 C1 ) |
| B | 689 127 C91 | COMPRESSOR ASSEMBLY, air (Consists of the following parts - |
| 1 | 272 920 | NUT, crankshaft |
| 2 | 328 528 C91 | SEAL, front cover oil |
| 3 | 630 179 C1 | COVER, front crankcase |
| | 179 817 | SCREW, hex-hd cap (5) |
| | 112 723 | WASHER, lock (5) |
| 4 | 630 180 C1 | GASKET, front cover |
| 5 | 205 368 R91 | BEARING, front and rear ball (2) |
| 6 | 25 920 HO | KEY, crankshaft woodruff |
| 7 | 630 181 C1 | CRANKSHAFT, air compressor |
| 8 | | CRANKCASE (Not Furnished Separately) |
| 9 | 302 031 R1 | GASKET, cylinder block (2) |
| 10 | 630 176 C1 | GASKET, crankcase base |
| 11 | | BASE, crankcase (Not furnished separately) |
| | 132 264 | SCREW, fil-hd (8) |
| | 103 319 | WASHER, lock (8) |
| 12 | 307 808 R1 | PLATE, inlet strainer (A) |
| 13 | 634 867 C1 | GASKET, strainer (A) (3) |
| 14 | 634 866 C1 | STRAINER, adapter (A) |
| 15 | 630 178 C1 | GASKET, rear cover |
| 16 | 38 882 DM | RING, rear oil seal |
| 17 | 630 177 C1 | COVER, rear crankcase |
| | 179 817 | SCREW, hex-hd cap (5) |
| | 112 723 | WASHER, lock (5) |
| 18 | 630 189 C1 | BOLT, connection rod (8) |
| 19 | 630 565 C91 | INSERT, rod bearing (Standard) (Replaces 630 185 C1) (2) |
| 19 | 630 566 C91 | INSERT, rod bearing (.005" undersize) (Replaces 630 186 C1) (x) |
| 19 | 630 567 C91 | INSERT, rod bearing (.010" undersize) (Replaces 630 187 C1) (x) |
| 19 | 630 568 C91 | INSERT, rod bearing (.015" undersize) (Replaces 630 188 C1) (x) |
| 20 | 228 673 R1 | BUSHING, wrist pin (Oversize)(4) |
| 21 | 630 184 C91 | ROD, assembly connecting w/two BOLT, 630 189 C1 and BUSHING, 228 673 R1) (4) |
| 22 | 302 120 R1 | LOCKWIRE, wrist pin (4) |
| 23 | | PISTON RING, wide (Standard) (Order RING SET, 637 384 C91) (8) |
| 23 | | PISTON RING, wide (.010" oversize) (Order RING SET, 637 385 C91) (x) |
| 23 | | PISTON RING, wide (.020" oversize) (Order RING SET, 637 386 C91) (x) |
| 23 | | PISTON RING, wide (.030" oversize) (Order RING SET, 637 387 C91) (x) |
| 24 | | PISTON RING, narrow (Standard) (Order RING SET, 637 384 C91) (12) |
| 24 | | PISTON RING, narrow (.010" oversize)(Order RING SET, 637 385 C91) (x) |
| 24 | | PISTON RING, narrow (.020" oversize) (Order RING SET, 637 386 C91) (x) |
| 24 | | PISTON RING, narrow (.030" oversize) (Order RING SET, 637 387 C91) (x) |
| 25 | 302 119 R1 | PIN, piston wrist (005" oversize) (x) |
| 26 | 303 048 R1 | COCK, 3/8" drain (2) |
| 27 | 179 816 | SCREW, hex-hd cap (A) (4) |
| 28 | 202 199 R11 | BLOCK, cylinder (2) |
| | 180 122 | SCREW, hex-hd cap (12) |
| | 110 730 | WASHER, lock (12) |
| 29 | 202 204 R1 | GASKET, cylinder head (2) |

(x) - As Required.

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| | | **AIR COMPRESSOR - Continued** (Bendix-Westinghouse) (TU-FLO-1000) (For 560) |
| 30 | 419 426 C91 | HEAD, cylinder (2) |
| | 288 188 C1 | SCREW, hex-hd cap (20) |
| 31 | 92 474 H | GASKET, disc fitting (2) |
| 32 | 3 072 253 R1 | STUD, 5/16" thread x 2-3/16" (4) |
| | 143 416 | NUT, NF (4) |
| | 112 723 | WASHER, lock (B) (4) |
| 33 | 302 041 R1 | VALVE, inlet (4) |
| 34 | 202 205 R2 | GUIDE, inlet valve (4) |
| 35 | 302 042 R1 | SPRING, inlet valve (4) |
| 36 | 630 183 C1 | WASHER, rod bolt lock (8) |
| 37 | 302 032 R11 | PISTON and PIN (Standard)(4) |
| 37 | 302 033 R11 | PISTON and PIN (.010" oversize) (x) |
| 37 | 302 034 R11 | PISTON and PIN (.020" oversize) (x) |
| 37 | 302 035 R1 | PISTON and PIN (.030" oversize) (x) |
| 38 | 634 867 C1 | GASKET, inlet adapter (A) (2) |
| | 182 077 R1 | GROMMET, unloader (x) |
| | 168 684 R91 | KIT, unloader piston repair (4) |
| | 637 384 C91 | RING SET, piston (Standard) (Consists of ten RINGS) |
| | 637 385 C91 | RING SET, piston (.010" oversize) (Consists of ten RINGS) |
| | 637 386 C91 | RING SET, piston (.020" oversize) (Consists of ten RINGS) |
| | 637 387 C91 | RING SET, piston (.030" oversize) (Consists of ten RINGS) |

(x) - As Required.



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FOR COMPLETE LISTING OF PARTS



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| REF. NO. | PART NUMBER | DESCRIPTION |
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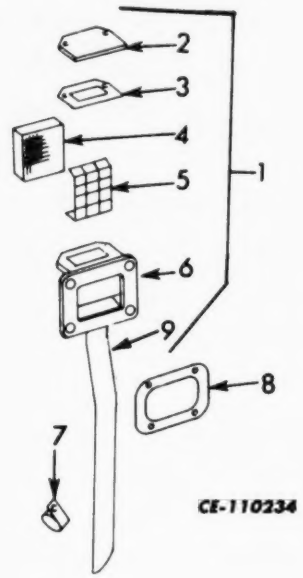
BREATHER PIPE, ELEMENT and RELATED PARTS




| | | |
|---|---|---|
| 1 | 671 378 C91 | BREATHER ASSY. (TD-25C, 330, 340, H-100C and D-120C - 10001 and Up) (H-560 - 11620 and Below also 14291 and Up) |
| 1 | 685 660 C91 | BREATHER ASSY. (H-560 - 11621 to 14290) |
| | 24 840 R1 | SCREW, hex-hd cap (4) |
| | 25 896 R1 | WASHER, hardened (4) |
| 2 | 671 382 C1 | COVER, breather housing |
| | 879 366 R1 | SCREW, hex-hd cap (2) |
| | 103 319 | WASHER, lock (2) |
| 3 | 671 383 C1 | GASKET, housing cover |
| 4 | 671 381 C1 | ELEMENT, breather |
| 5 | 671 394 C1 | RETAINER, breather element |
| 6 | | HOUSING, breather (Not Furnished Separately) |
| 7 | 349 465 R1 | CLIP, breather pipe |
| 8 | 279 713 R1 | GASKET, breather |
| 9 | | PIPE, breather (Not Furnished Separately) |



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| 19 968 R1 | 7 - 3 | 24 842 R1 | 5 - 7 | 25 484 R1 | 15 - 5 | 25 895 R1 | 15 - 3 |
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# SUPPLEMENTAL OPERATING MAINTENANCE AND REPAIR PARTS INSTRUCTIONS


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# SECTION I
# GENERAL

## 1-1. Purpose

To provide user and support personnel supplemental maintenance and repair parts instructions that have special application to Commercial Construction Equipment (CCE) items.

## 1-2. Scope

This publication applies to Department of the Army Units, Organizations and Activities that use/or support the CCE Scoop Loader IHC Model H-100C.

## 1-3. Description

*a.* This loader is a commercial $4^1/_2$—5 cubic yard capacity Loader, Scoop Type, DED, 4 x 4, Articulated Frame Steering: International Harvester Company Model H100C, rubber-tire mounted. When equipped with the $4^1/_2$ cubic yard spade nose rock bucket it is referred to as the Type I Loader (NSN 3805-01-052-9042). When equipped with a 5 cubic yard general purpose bucket it is referred to as the Type II Loader (NSN 3805-01-052-9043). The loader will be identified by the CCE Manufacturer's Serial Number and the United States Army (USA) Number.

*b.* The loader is powered by an International Harvester Engine DT-817C which develops 290 Net HP at the flywheel and 320 maximum horse power at 2100 RPM. The power train consists of a single stage, single phase, three element torque converter, an input charging pump and a power take-off to drive the loader system pump and the combination power steering-cooling circuit pump. The torque converter drives a full power shift transmission. The transmission has four speeds in both forward and reverse, and full power shift in all ranges. Both axles are full floating, double reduction type. The axles are rigidly attached to their supporting members; the front main frame is the case for the front axle and an oscillating cradle called a bolster for the rear. By allowing the rear axle to oscillate, the tractor is assured greater stability in rough terrain. The first gear reduction takes place in the differential; the second in the planetaries. Each wheel revolves on two tapered roller bearings mounted on the axle spindle. The axles are full floating. None of the weight is supported by, or transmitted to, the axle shafts. All weight on the axle is supported by the wheels, bearings and axle housings. The differential assemblies are rigidly mounted, one on the forward side of the rear axle housing and one on the rear side of the front axle housing. The differentials are connected by splined yokes on the propeller shafts from the transmission.

The brake system is a combination of air over hydraulic. An engine driven compressor supplies compressed air for the system. The compressed air is stored in the air reservoir and the output is regulated by a governor between the compressor and the reservoir at 90 to 105 PSI. The hydraulic system is a closed system with controlled pressure and vacuum relief. The reservoir has a capacity of approximately 54 gallons. The loader has a speed of 21.4 MPH. The fuel tank capacity is 115 gallons, and the equipment will use approximately 50.4 gallons of diesel fuel with the engine operating at 2100 RPM, for a period of 5 hours. With the engine lubrication oil levels filled as prescribed, lubrication oil pressure will be maintained on a 30% side slope and a 60% longitudinal slope.

*c. Dimensions and Other Pertinent Data.*

(1) Length — 29 Feet 5 Inches
(2) Width — 125 Inches
(3) Height with Cab — 12 Feet $2^1/_2$ Inches
(4) Clearance Circle Measured to Outside of Tire Tread — 43 Feet 1 Inch
(5) Dump Height — 124 Inches @ $40^0$ Dump Angle
(6) Reach — 65 Inches @ $40^0$ Dump Angle and 124 Inches Dump Height
(7) Raising Time — 6.5 Seconds
(8) Drawbar Pull 25,642 lbs. at 2.1 MPH

*d. Bucket.* A general purpose bucket with an SAE nominal heaped rating of 5 cubic yards, and eight (8) bolt on teeth with replaceable tooth tips is installed on the vehicle. Measured width of bucket — 130.5 inches.

*e. Rock Bucket.* The spade nose rock bucket has an SAE nominal heaped rating of $4^1/_2$ cubic yards.

Measured width of bucket — 130 inches.

*f. Steering System.* The loader has articulated frame steering with 38 degrees of articulation in each direction.

*g. Tires.* The tires are Super-Rock Grip 26.5 x 25 L–4 tires. All tires have a 20 ply rating and are inflated to 50 PSI. Sufficient clearance is provided to mount the L–5 type tires without removal of any components.

*h. Electrical System.* The loader has a 24 volt electrical starting and lighting system with necessary fuses and circuit breakers. All control switches are located on the dash within reach of operator. The system has a negative ground circuit.

*i. Alternator.* The loader is equipped with an engine driven alternator and compatible regulator self contained. The alternator is 24 volts with 45 amp rating.

*j. Instruments.* The loader is equipped with waterproof gages and switches. The gages are illuminated by rear lighting and identified on the instrument panel. The following instruments are on the panel:

(1) Engine Coolant Temperature Gage
(2) Voltmeter
(3) Engine Oil Pressure Gage
(4) Torque Converter Oil Temperature Gage
(5) Air Pressure Gage
(6) Fuel Level Gage
(7) Engine Hourmeter

*k. Battery.* Four (4) 6 volt batteries are installed in a series to provide 24 volts for the starting system. The batteries are located on either side of the hydraulic reservoir on the rear frame.

## 1–4. Operation Concept

The $4^1/_2$ to 5 cubic yard Scoop Loader is to be used by engineer construction units equipped with Commercial Construction Equipment (CCE). The increased loader capability is required for compatibility with the increased haul capability of the 20 ton on-off highway dump truck and the quarry truck and concrete mobile mixer. This scoop loader will be used to excavate and load consolidated earth, blast rock, loose or decomposed rock, sand, aggregate and loose soil from stockpiles into dump trucks, concrete mobile mixers, hoppers and aggregate bins.

## 1–5. Procurement Status

*a.* This is a multi-year (3 years) procurement.

*b.* The procurement was awarded under contract DSA 700–77–C–8542, to International Harvester Company, 600 Woodfield, Schaumburg, IL 60196.

## 1–6. Personnel and Training

*a. MOS Requirements.*

(1) Operator: Rough terrain, fork lift, and loader operator, MOS 62B20.

(2) Organizational: Engineer equipment repairman, MOS 62B20.

(3) Direct/General Support: Engineer equipment repairman, MOS 62B30.

*b. New Equipment Training.* New Equipment Training Teams (NETTs) are available to major field commands. Requests for NETTs should be forwarded to Commander, US Army Tank-Automotive Materiel Readiness Command (TARCOM), ATTN: DRSTA–MLT, Warren, MI 48090. Training teams should be requested only when trained personnel are not available in the command to operate and/or maintain the scoop loader.

## 1–7. Logistics Assistance (AR 700–4)

US Army Tank-Automotive Materiel Readiness Command's Field Maintenance Technicians stationed at OCONUS installations are available to furnish on-site training and/or technical assistance. When training or technical assistance is required, contact the appropriate Logistics Assistance Office (LAO) listed in appendix B, AR 700–4.

## 1–8. Warranty

The contractor warrants for 15 months or 1500 hours whichever comes first, that all supplies furnished under the contract will be free from defects in material or workmanship and will conform with the specifications and all other requirements of the contract. Failure of defective components, parts or assemblies covered by the manufacturer's warranty will be processed by the using unit under the warranty claims actions published in TM 38–750. See appendix B for additional warranty guidelines.

# SECTION II
# MAINTENANCE

## 2–1. Maintenance Concept

The loader will not require any new or special maintenance considerations. All maintenance functions can be accomplished within the current maintenance concepts established for construction equipment.

*a. Operator/Crew Maintenance:* Operator and crew maintenance is limited to daily preventive maintenance checks and services.

*b. Organizational Maintenance:* Organizational maintenance consists of scheduled preventive maintenance services, minor repairs and adjustments.

*c. Direct Support Maintenance:* Direct support maintenance consists of repairs on-site or in a direct support unit shop. Repairs are accomplished with a minimum of tools and test equipment; the assemblies and end items thus repaired are returned to their users.

*d. General Support Maintenance:* General support maintenance overhauls selected assemblies and repairs items designated by the area support command for return to stock.

*e. Depot Maintenance:* Depot maintenance overhauls end items and selected major assemblies when they are required to satisfy overall Army requirements. Overhaul of the end item may also be performed by contract with the manufacturer.

## 2–2. Maintenance Allocation Chart

Maintenance will be performed as necessary by the category indicated in the Maintenance Allocation Chart (MAC) (app C) to retain or restore serviceability. All authorized maintenance within the capability of a using organization will be accomplished before referring the item to support maintenance. Higher categories will perform the maintenance functions of lower categories when required or directed by the appropriate Commanders. Using and support units may exceed their authorized scope and functions in the MAC when approval is granted by the next higher support maintenance Commander.

## 2–3. Modifications

Modifications will be accomplished by the end item manufacturer after TARCOM approves the field campaign or modification plan. See appendix D.

## 2–4. Equipment Improvement Recommendations (EIR)

Equipment Improvement Recommendations will be submitted in accordance with TM 38–750.

## 2–5. Equipment Readiness Reporting

Readiness Reporting will be accomplished as required by current TM 38–750.

## 2–6. Maintenance Expenditure Limits

The average life expectancy for the loader is 15 years.

| *Percent of Repair* | *Year* |
|---|---|
| 50% | 1981 |
| 45% | 1983 |
| 40% | 1985 |
| 35% | 1987 |
| 30% | 1989 |
| 20% | 1992 |

## 2–7. Shipment and Storage

*a. Shipment and Storage.* Refer to TB 740–97–2 for procedures covering preservation of equipment for shipment and storage.

*b. Administrative Storage.* Refer to TM 740–90–1 for instructions covering administrative storage of equipment.

## 2–8. Destruction to Prevent Enemy Use

Refer to TM 750–244–3 for procedures covering destruction of equipment to prevent enemy use.

## 2–9. Fire Protection

*a.* A hand operated fire extinguisher may be installed at the discretion of the using unit.

*b.* Approved hand-portable fire extinguishers are listed in TB 5–4200–200–10.

## 2-10. Basic Issue Items List (BIIL)

See appendix E for a list of items which accompany the end item or are required for operation and/or operator's maintenance.

## 2-11. Maintenance and Operating Supply List

See appendix F for a list of maintenance and operating supplies required for initial operation.

## 2-12. Special Tools and Equipment

No special tools or equipment are required for operation and maintenance of the Loader.

## 2-13. Maintenance Forms and Records

Operational Maintenance and Historical Records will be maintained as required by the current TM 38-750.

# SECTION III
# REPAIR PARTS SUPPLY

## 3-1. General

*a.* The basic policies and procedures in AR 710-2 and AR 725-50 are generally applicable to repair parts management for CCE items.

*b.* Manufacturer's parts manuals are furnished with CCE items instead of Department of the Army Repair Parts and Special Tool List (RPSTL).

*c.* National Stock Number (NSN's) are initially assigned only to PLL/ASL parts and major assemblies; i.e., engines, transmissions, etc. Additional NSN's are assigned by the supply support activities as demands warrant.

*d.* Automated Processing (AUTODIN) of Federal Supply Code Manufacturer (FSCM) part number requisitions, without edit for matching NSN's and exception data, is authorized.

*e.* Proper use of project codes and weapon systems designator codes on parts requisitions is essential.

*f.* Repair parts are available from commercial sources and may be purchased locally in accordance with AR 710-2 and AR 735-110.

*g.* Initial Prescribed Load List (PLL) and Authorized Stock List (ASL) will be distributed by US Army Tank-Automotive Materiel Readiness Command (TARCOM), ATTN: DRSTA-FHV.

## 3-2. Prescribed Load List (PLL)

The PLL distributed by TARCOM is an estimated 15 days supply recommended for initial stockage at organizational maintenance. Management of PLL items will be governed by the provisions of AR 710-2 and local command procedures. Selection of PLL parts for shipment to CONUS/OCONUS units is based upon the receiving Command's recommendation after their review of the TARCOM prepared list. Organizations and activities in CONUS/OCONUS will establish PLL stocks through normal requisitioning process.

## 3-3. Authorized Stockage List (ASL)

The ASL distributed by TARCOM is an estimated 45 days supply of repair parts for support units and activities. The ASL parts will be shipped according to the recommendations of the receiving commands, after they have reviewed the initial list distributed by TARCOM. Support units and activities in CONUS/OCONUS will establish ASL stocks through normal requisitioning process.

## 3-4. Requisitioning Repair Parts

*a. Using Units/Organizations:* Requisitions (DA Form 2765 Series) will be prepared according to AR 710-2 and local command directives. All requisitions will have the Weapons System Designator Code "37" entered in the 2nd and 3rd positions of block 18. Units in CONUS will use Project Code "BGW" in block 19. Units OCONUS will enter in block 19 Project Code "JZC", appendix G.

*b. Support Units and Activities:*

(1) *General:* All MILSTRIP requisitions (DD Form 1348 Series) prepared for repair parts support of CCE items will include distribution and project codes, (see appendixes H, I, and J).

(2) *Distribution code:* Supply customers in CONUS will use Code "F" in card column 54. Customers OCONUS will use the appropriate code from appendix P, AR 725-50. Weapons System Designator Code "37" will be entered in card columns 55 and 56 of all requisitions for parts to support the Loader.

(3) *Project codes:* The Project Code "BGW" will be used by CONUS customers when requisitioning part numbered parts. Supply customers OCONUS will use Project Code "JZC" for part numbered parts.

## 3-5. Submitting Requisitions

*a.* Using Units and Organizations will submit DA Form 2765 Series Requisitions to designated support units or activities in accordance with local procedures.

*b.* Support units and activities will forward MILSTRIP requisitions for NSN parts through the Defense Automated Addressing System (DAAS) to the Managing Supply Support Activity. Requisitions for part numbered part will be forwarded through DAAS to the Defense Construction Supply Center (DCSC)

**NOTE:**

When the manufacturer's part number and Federal Supply Code for Manufacturer (FSCM) exceed the space in card columns 8 through 22 of A02/A0B requisitions, prepare an A05A0E requisition (DD Form 1348–6) and mail it to Commander, Defense Construction Supply Center, ATTN: DCSC–OSR, Columbus, Ohio 43215.

# APPENDIX A
# REFERENCES

## A-1. Fire Protection and Safety

TB 5-4200-200-10 Hand Portable Fire Extinguishers Approved for Army Users.

## A-2. Lubrication

C 9100-IL Identification List for Fuels Lubricants, Oils and Waxes.

## A-3. Maintenance

TB 750-651 Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems.

TM 9-6140-200-14 Operator's, Organizational, Direct Support and General Support Maintenance Manual for Lead-Acid Storage Batteries; 4HN, 24V (NSN 6140-00-059-3528) MS 75047-1; 2HN, 12V (6140-00-057-2553) MS 35000-1; 6TN, 12V (6140-00-057-2554) MS 35000-3.

TM 38-750 The Army Maintenance Management System (TAMMS).

## A-4. Shipment and Storage

TM 740-90-1 Administrative Storage of Equipment.

TB 740-97-2 Preservation of USAMECOM Mechanical Equipment for Shipment and Storage.

## A-5. Demolition

TM 750-244-3 Procedures for Destruction of Equipment to Prevent Enemy Use (Mobility Equipment Command).

## A-6. Operation

TM 5-331A Utilization of Engineer Construction Equipment: Volume A; Earthmoving, Compaction, Grading and Ditching Equipment.

# APPENDIX B
# WARRANTY GUIDELINES

## B-1. Warranty Period

A warranty period of 15 months or 1500 hours applies to the loader, Model H-100C, Contract No. DSA700-77-C-8542, manufactured by International Harvestor, after delivery to the Government. This warranty applies to the end item, components and all supplies furnished under the contract.

## B-2. Warranty Claim Adjustment

Using units may contract their local dealer for warranty claim adjustment. However, guidelines set forth in paragraph B-3 must be followed.

## B-3. General Information

*a.* DA Form 2407 (prepared in accordance with warranty claim actions in TM 38-750) will be used to submit warranty claims actions for end items when components, parts or assemblies are defective and are covered by a manufacturer's warranty. End items under warranty are identified by a decal plate and/or warranty statement included in the operator's and maintenance manual for the end item. *All warranty actions* settled or unsettled will be *reported to the National Maintenance Point (NMP)* on DA Form 2407. For warranties settled locally the DA Form 2407 will contain a statement "For Information Only" in block 35.

*b.* Maintenance activities in support of organizational maintenance are the responsible points of contact between the originator of warranty claims and the National Maintenance Point (US Army Tank-Automotive Materiel Readiness Command, ATTN: DRSTA-MVB, Warren, MI, 48090) which serves as the DA Representative with the contractor in warranty matters.

**NOTE:**

In certain instances, the originating organization and the support activity are one and the same.

*c.* Before you take your equipment to a dealer for repair, whether or not it was necessary for you to go through the NMP (TARCOM), check with your local procurement office to see if a funds commitment document is needed. Sometimes, even though the majority of the repairs are covered by the warranty, there may be a small charge for normal maintenance costs, i.e., oil filters, oil, etc. Further, the cause of damage could be determined by the dealer to be directly related to "operator abuse". In that case, the Government may be obligated to pay for teardown services even if the repairs are no longer desired, or for the complete cost if repairs are to be completed by the dealer.

*d.* When the equipment is given to the dealer for repairs, find out how long the work will take, the extent of the problem, if possible, and the charges, if any, which may be involved. Leave the name and telephone number of the person to be contacted for pickup of the equipment and specifically state that he should be called as soon as the repairs are finished. In addition, state that he should be telephoned if unexpected problems, costs and/or delays are encountered. Get the name and telephone number of the Service Manager, for any required follow-up purposes.

*e.* When you arrive to pick up your equipment after completion of services, make certain that you know exactly what repairs were performed and/or parts replaced. This is required for over-all problem trend evaluation by the NMP and must be identified upon completion of warranty services.

*f.* Telephone the NMP at TARCOM, AUTOVON 273-3349, 273-3439 and/or 273-3387 if:

(1) Your equipment required repairs and you cannot obtain these services using the procedures listed above.

(2) The length of time required for repairs may seriously hamper your mission, or if the dealer's overall response to your requirements are not satisfactory.

(3) You have any questions regarding warranty procedures either in general or about a specific job. Do not wait until your problems become critical.

*g. Do not attempt to conduct negotiations regarding a breach of warranty.* This is a function of the Contracting Officer, through the NMP at TARCOM.

# APPENDIX C

## MAINTENANCE ALLOCATION CHART

### Section I. INTRODUCTION

**C-1. General**

*a.* This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

*b.* The Maintenance Allocation Chart (MAC) in section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

*c.* Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section II.

*d.* Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

**C-2. Maintenance Functions.** Maintenance functions will be limited to and defined as follows:

*a. Inspect.* To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

*b. Test.* To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

*c. Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean (including decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

*d. Adjust.* To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

*e. Aline.* To adjust specified variable elements of an item to bring about optimum or desired performance.

*f. Calibrate.* To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

*g. Remove/Install.* To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a space, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

*h. Replace.* To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the third position of the SMR code.

*i. Repair.* The application of maintenance service[1], including fault location/troubleshooting[2], removal/installation, disassembly/assembly[3] procedures, and maintenance actions[4] to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

*j. Overhaul.* That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publication (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

[1]Service – inspect, test, service, adjust, aline, calibrate, and/or replace.

[2]Fault locating/troubleshooting – The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

[3]Disassembly/assembly – encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration.

[4]Action – welding, grinding, riveting, straightening, facing, remachining, and/or resurfacing.

*k. Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

## C-3. Explanation of Columns in the MAC, Section II

*a. Column 1, Group Number.* Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group number shall be "00".

*b. Column 2, Component/Assembly.* Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

*c. Column 3, Maintenance Function.* Column 3 lists the function to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph C-2).

*d. Column 4, Maintenance Category.* This column specifies the average total manhours required to do the job. For example, if it takes two people five hours to complete the job, the figure would be ten. This figure represents the time required to perform the job at the lowest indicated category of maintenance and restore the item to a serviceable condition. It includes disassembly, troubleshooting, quality assurance and assembly. The symbol designations for the various maintenance categories are as follows:

C — Operator or Crew
O — Organizational Maintenance
F — Direct Support Maintenance
H — General Support Maintenance
D — Depot Maintenance

*e. Column 5, Tools and Equipment.* Column 5 specifies by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

*f. Column 6, Remarks.* This column shall, when applicable, contain a letter code, in alphabetical order, which shall be keyed to the remarks contained in Section IV.

## C-4. Explanation of Columns in Tool and Test Equipment Requirements, Section III

*a. Column 1, Reference Code.* The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

*b. Column 2, Maintenance Category.* The lowest category of maintenance authorized to use the tool or test equipment.

*c. Column 3, Nomenclature.* Name or identification of the tool or test equipment.

*d. Column 4, National Stock Number.* The National stock number of the tool or test equipment.

*e. Column 5, Tool Number.* The manufacturer's part number.

## C-5. Explanation of Columns in Remarks, Section IV

*a. Column 1, Reference Code.* The code recorded in column 6, Section II.

*b. Column 2, Remarks.* This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

## Section II. MAINTENANCE ALLOCATION CHART

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 01 | ENGINE | | | | | | | | |
| 0100 | Engine Assembly | Test | | | 1.0 | | | 1,2,5, | |
| | | Service | | 1.0 | | | | 17,19, | |
| | | Adjust | | | 1.0 | | | 22 | |
| | | Aline | | | 2.0 | | | | |
| | | Replace | | | 9.5 | | | | |
| | | Repair | | | | 5.0 | | | |
| | | Overhaul | | | | 55.0 | | | |
| | Engine Mounting | Replace | | | 2.0 | | | | |
| 0101 | Crankcase, Block, Cylinder Head | | | | | | | 1,20 | |
| | Crankcase | Replace | | | | 60.0 | | | |
| | | Repair | | | | 5.0 | | | |
| | Cylinder Heads Assembly | Replace | | | 8.0 | | | | |
| 0102 | Crankshaft | Inspect | | | | 0.5 | | 1,3,12, | |
| | | Replace | | | | 16.0 | | 18 | |
| | | Overhaul | | | | 18.0 | | | |
| | Bearings, Main | Inspect | | | | 2.0 | | | |
| | | Replace | | | | 4.0 | | | |
| | Damper | Replace | | | 5.0 | | | | |
| 0103 | Flywheel Assembly | Replace | | | | 16.0 | | 1 | |
| | | Repair | | | | 1.5 | | | |
| | Flywheel Housing | Replace | | | 11.0 | | | | |
| | | Repair | | | 2.0 | | | | |
| 0104 | Pistons, Connecting Rods | | | | | | | 1,11 | |
| | Pistons | Inspect | | | | 1.0 | | | |
| | | Replace | | | | 14.0 | | | |
| | Connecting Rod | Replace | | | | 14.0 | | | |
| | | Repair | | | | 1.0 | | | |
| | Bearings, Connecting Rod | Replace | | | | 1.0 | | | |
| 0105 | Valves, Camshafts and Timing System | | | | | | | 1,6 | |
| | Rocker Arm Assembly | Adjust | | | 1.0 | | | | |
| | | Replace | | | | 3.0 | | | |
| | Valves | Replace | | | | 4.0 | | | |
| | Camshaft | Replace | | | | 16.5 | | | |
| | Gear and Shaft, Idler Pump | Replace | | | 12.5 | | | | |
| | Timing Gears | Replace | | | | 15.5 | | | |
| 0106 | Engine Lubrication System | | | | | | | | |
| | Oil Pan | Replace | | | 5.0 | | | | |
| | | Repair | | | 1.0 | | | | |
| | Body Assembly, Oil Pump | Replace | | | | 8.0 | | | |
| | | Repair | | | | 1.0 | | | |
| | | Overhaul | | | | 2.0 | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 01 | ENGINE – CONTINUED | | | | | | | | |
| 0106 | Engine Lubrication System – Continued | | | | | | | | |
| | Oil Cooler | Replace | | | 4.0 | | | | |
| 0108 | Manifolds | | | | | | | 1 | |
| | Manifolds, Intake and Exhaust | Replace | | | 4.5 | | | | |
| 03 | FUEL SYSTEM | | | | | | | | |
| 0301 | Carburetor, Fuel Injector | | | | | | | 1,13,14, | |
| | Nozzles and Holders | Test | | | 1.0 | | | 15,16, | |
| | | Replace | | | 1.0 | | | 21 | |
| | | Repair | | | 1.5 | | | | |
| | Pipes, Fuel Injector | Inspect | 0.1 | | | | | | |
| | | Replace | | | 1.0 | | | | |
| 0302 | Fuel Pumps | | | | | | | 1 | |
| | Pump, Fuel Injector | Test | | | 1.0 | | | | |
| | | Replace | | | 2.5 | | | | |
| | | Repair | | | 5.5 | | | | |
| | Fuel Hoses and Tubes | Replace | | | 2.0 | | | | |
| 0304 | Air Cleaner | Service | 0.2 | | | | | 1 | |
| | | Replace | | 0.5 | | | | | |
| | | Repair | | 0.5 | | | | | |
| 0305 | Supercharger, Blower or Turbocharger | | | | | | | 1 | |
| | Turbocharger | Service | | 1.0 | | | | | |
| | | Replace | | 1.5 | | | | | |
| | | Repair | | | | 2.0 | | | |
| | | Overhaul | | | | 3.0 | | | |
| 0306 | Tanks, Lines, Fittings, Headers | | | | | | | 1 | |
| | Fuel Tank | Service | | 0.5 | | | | | |
| | | Replace | | 2.0 | | | | | |
| | | Repair | | | 2.0 | | | | |
| 0308 | Engine Speed Governor and Controls | | | | | | | 1 | |
| | Lever and Rod | Replace | | | 2.0 | | | | |
| 0309 | Fuel Filters | Service | | 0.5 | | | | 1 | |
| | | Replace | | 0.5 | | | | | |
| 0311 | Engine Starting Aids | | | | | | | 1 | |
| | Ether Starting Kit | Service | | 0.5 | | | | | |
| | | Replace | | 1.0 | | | | | |
| | | Repair | | 1.0 | | | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 03 | FUEL SYSTEM – CONTINUED | | | | | | | | |
| 0312 | Accelerator, Throttle or Choke Controls | | | | | | | 1 | |
| | Cables | Service | | 0.5 | | | | | |
| | | Adjust | | 0.5 | | | | | |
| | | Replace | | 2.0 | | | | | |
| 04 | EXHAUST SYSTEM | | | | | | | | |
| 0401 | Muffler and Pipes | Service | | 1.0 | | | | 1 | |
| | | Replace | | 1.0 | | | | | |
| 05 | COOLING SYSTEM | | | | | | | | |
| 0501 | Radiator, Evaporative Cooler, or Heat Exchanger | | | | | | | 1 | |
| | Radiator Core | Inspect | 0.1 | | | | | | |
| | | Service | | 0.5 | | | | | |
| | | Replace | | | 3.0 | | | | |
| | Oil Cooler, Transmission | Replace | | | 2.5 | | | | |
| | Grille | Replace | | | 1.0 | | | | |
| 0502 | Cowling, Deflectors, Air Ducts, Shrouds, Etc. | | | | | | | 1 | |
| | Shroud | Replace | | 1.0 | | | | | |
| | | Repair | | | 1.0 | | | | |
| 0503 | Water Manifold, Headers, Thermostats and Housing Gasket | | | | | | | 1 | |
| | Water Manifold | Replace | | 2.0 | | | | | |
| | Thermostats | Test | | 1.0 | | | | | |
| | | Replace | | 1.0 | | | | | |
| | Hoses, Lines and Fittings | Service | | 0.5 | | | | | |
| | | Replace | | 1.0 | | | | | |
| 0505 | Fan Assembly | | | | | | | 1,4,5, 10 | |
| | Fan Drive Assembly | Replace | | | 1.5 | | | | |
| | | Repair | | | 1.5 | | | | |
| 0508 | Water Filter | | | | | | | 1 | |
| | Tube Assemblies | Replace | | | 1.0 | | | | |
| | | Repair | | | 0.5 | | | | |
| | Filter Element | Replace | | | 0.5 | | | | |
| 06 | ELECTRICAL SYSTEM | | | | | | | | |
| 0601 | Generator, Alternator | | | | | | | 1 | |
| | Alternators | Test | | 0.5 | | | | | |
| | | Replace | | 1.5 | | | | | |
| | | Repair | | | 1.0 | | | | |
| | | Overhaul | | | | 1.5 | | | |
| | Drive Belt | Adjust | | 0.4 | | | | | |
| | | Replace | | 0.4 | | | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 06 | ELECTRICAL SYSTEM – CONTINUED | | | | | | | | |
| 0603 | Cranking Motor Assembly | Test | | 0.5 | | | | 1 | |
| | | Service | | | 0.5 | | | | |
| | | Replace | | 1.0 | | | | | |
| | | Repair | | | 1.0 | | | | |
| | Switch Assembly | Test | | 0.3 | | | | | |
| | | Replace | | | 0.5 | | | | |
| | | Repair | | | 0.5 | | | | |
| 0607 | Instrument or Engine Control Panel | | | | | | | 1 | |
| | Instrument Panel | Replace | | | 1.0 | | | | |
| | Gage, Fuel | Test | | 0.5 | | | | | |
| | | Replace | | | 0.2 | | | | |
| | Temperature Gage | Test | | 0.5 | | | | | |
| | | Replace | | | 1.0 | | | | |
| | Meter, Time | Replace | | | 0.2 | | | | |
| 0609 | Lights | | | | | | | 1 | |
| | Head, Tail and Stop Lights | Replace | | 0.2 | | | | | |
| | | Repair | | 0.5 | | | | | |
| 0610 | Sending Units and Warning Switches | | | | | | | 1 | |
| | Oil Pressure Sending Unit | Replace | | 0.2 | | | | | |
| | Engine Temperature Sending Unit | Test | | 0.4 | | | | | |
| | | Replace | | 0.5 | | | | | |
| 0612 | Batteries, Storage | | | | | | | 1 | |
| | Batteries | Test | | 0.5 | | | | | |
| | | Service | | 0.5 | | | | | |
| | | Replace | | 0.5 | | | | | |
| | | Repair | | | 1.0 | | | | |
| | Covers | Service | | 0.5 | | | | | |
| | | Replace | | 0.5 | | | | | |
| 0613 | Chassis Wiring Harness | | | | | | | 1 | |
| | Battery Cables | Inspect | 0.1 | | | | | | |
| | | Replace | | | 0.3 | | | | |
| | Wiring Harness, Engine and Instrument | Inspect | 0.1 | | | | | | |
| | | Test | | 1.0 | | | | | |
| | | Replace | | | 1.0 | | | | |
| | | Repair | | | 2.5 | | | | |
| 07 | TRANSMISSION | | | | | | | | |
| 0705 | Transmission Shifting Components | | | | | | | 1,7,8 | |
| | Levers and Control Cables | Replace | | 1.5 | | | | 1 | |
| 0708 | Torque Converter of Fluid Coupling | | | | | | | 1 | |
| | Torque Converter | Replace | | | 5.0 | | | | |
| | | Repair | | | | 9.5 | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 07 | TRANSMISSION – CONTINUED | | | | | | | | |
| 0708 | Torque Converter of Fluid Coupling – Continued | | | | | | | | |
| | Hoses | Replace | | | 1.0 | | | 1 | |
| 0710 | Transmission Assembly | Inspect | | 0.2 | | | | 1,7,8 | |
| | | Test | | 0.5 | | | | | |
| | | Replace | | | 8.0 | | | | |
| | | Repair | | | | 8.0 | | | |
| | | Overhaul | | | | 21.0 | | | |
| 0713 | Intermediate Clutch Clutch Package Assembly | | | | | | | 1 | |
| | | Replace | | | | 12.0 | | | |
| | | Repair | | | | 12.0 | | | |
| | | Overhaul | | | | 16.0 | | | |
| 0721 | Coolers, Pumps, Motors Valve, Range Selector | | | | | | | 1 | |
| | | Replace | | | 1.5 | | | | |
| | | Repair | | | | 2.5 | | | |
| | | Overhaul | | | | 5.0 | | | |
| | Forward and Reverse Valve | Replace | | | 1.0 | | | | |
| | | Repair | | | | 1.5 | | | |
| | | Overhaul | | | | 3.0 | | | |
| | Pump Oil, Charging | Inspect | | 0.2 | | | | | |
| | | Test | | | 0.5 | | | | |
| | | Replace | | | 4.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| | | Overhaul | | | | 4.0 | | | |
| | Main Regulator Valve | Test | | | 0.5 | | | | |
| | | Service | | 0.5 | | | | | |
| | | Replace | | | 1.0 | | | | |
| | | Repair | | | | 2.0 | | | |
| | | Overhaul | | | | 3.0 | | | |
| | Converter Oil Filter | Replace | | | 0.5 | | | | |
| | | Repair | | | | 0.3 | | | |
| 09 | PROPELLER, PROPELLER SHAFTS, UNIVERSAL JOINTS, COUPLER AND CLAMP ASSEMBLY | | | | | | | | |
| 0900 | Propeller Shafts | | | | | | | | |
| | Propeller Shaft, Transmission to Transfer Drive | Replace | | 1.5 | | | | 1 | |
| | | Repair | | 1.5 | | | | | |
| | Propeller Shaft, Transmission to Front Axle | Inspect | 0.1 | | | | | | |
| | | Service | | 0.5 | | | | | |
| | | Replace | | 1.5 | | | | | |
| | | Repair | | 1.0 | | | | | |
| | Propeller Shaft, Transmission to Rear Axle | Inspect | 0.1 | | | | | | |
| | | Service | | 0.5 | | | | | |
| | | Replace | | 1.5 | | | | | |
| | | Repair | | 1.0 | | | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 09 | PROPELLER, PROPELLER SHAFTS, UNIVERSAL JOINTS, COUPLER AND CLAMP ASSEMBLY – CONTINUED | | | | | | | | |
| 0900 | Propeller Shafts – Continued | | | | | | | 1 | |
| | Drive Shaft, Converter to Transmission | Replace | | 1.5 | | | | | |
| | | Repair | | 1.0 | | | | | |
| | Transfer Drive Assembly | Service | | 0.5 | | | | | |
| | | Replace | | 2.0 | | | | | |
| | | Repair | | | 2.0 | | | | |
| 10 | FRONT AXLE | | | | | | | | |
| 1000 | Front Axle Assembly | Service | | 0.1 | | | | 1,9,23 | |
| | | Replace | | | 5.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| | | Overhaul | | | | 8.0 | | | |
| 1002 | Differential | Service | | 0.1 | | | | 1 | |
| | | Replace | | | 8.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| | | Overhaul | | | | 4.0 | | | |
| 1003 | Planetary or Final Drive Carrier Gear Planetary Assembly | Service | | 0.5 | | | | 1,23 | |
| | | Replace | | | 4.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| | | Overhaul | | | | 4.0 | | | |
| 11 | REAR AXLE | | | | | | | | |
| 1100 | Rear Axle Assembly | Service | | 0.2 | | | | 1 | |
| | | Replace | | | 5.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| | | Overhaul | | | | 8.0 | | | |
| 1101 | Housing, Beam, Housing Covers Plugs, Seals, Etc. Axle Assembly | | | | | | | 1 | |
| | | Replace | | | 5.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| 1102 | Differential | Inspect | | 0.1 | | | | 1,9 | |
| | | Service | | 0.2 | | | | | |
| | | Replace | | | 8.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| | | Overhaul | | | | 4.0 | | | |
| 1103 | Planetary or Final Drive Carrier Gear Planetary Assembly | Service | | 0.5 | | | | 1 | |
| | | Replace | | | 4.0 | | | | |
| | | Repair | | | | 4.0 | | | |
| | | Overhaul | | | | 4.0 | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 12 | BRAKES | | | | | | | | |
| 1201 | Hand Brakes | | | | | | | | |
| | Parking Brake Lever | Service | | 0.2 | | | | 1 | |
| | | Adjust | | 0.5 | | | | | |
| | | Replace | | | 1.0 | | | | |
| | | Repair | | | | 1.0 | | | |
| | Parking Brake Assembly | Service | | 0.5 | | | | | |
| | | Adjust | | 0.5 | | | | | |
| | | Replace | | | 2.5 | | | | |
| | | Repair | | | | 2.0 | | | |
| 1202 | Service Brakes | Service | | 1.0 | | | | 1 | |
| | | Adjust | | 1.0 | | | | | |
| | | Replace | | | 1.2 | | | | |
| | | Repair | | | | 4.0 | | | |
| 1204 | Hydraulic Brake System | | | | | | | | |
| | Spider Assembly | Inspect | 0.1 | | | | | 1 | |
| | | Replace | | | | 8.0 | | | |
| | | Repair | | | | 4.0 | | | |
| | Power Cluster Assemblies | Inspect | 0.1 | | | | | | |
| | | Replace | | | | 0.5 | | | |
| | | Repair | | | | 1.0 | | | |
| 1208 | Air Brake System | | | | | | | | |
| | Treadle Valves, Left and Right | Service | | 0.1 | | | | 1 | |
| | | Replace | | 0.5 | | | | | |
| | | Repair | | | 0.5 | | | | |
| | Hose and Tube Assemblies | Service | 0.1 | | | | | | |
| | | Replace | | | 0.3 | | | | |
| | | Repair | | | 0.5 | | | | |
| | Reservoirs | Service | 0.1 | | | | | | |
| | | Replace | | | 0.3 | | | | |
| | Relay Valve | Replace | | 1.5 | | | | | |
| | | Repair | | | 1.5 | | | | |
| | Alcohol Injector | Replace | | 0.6 | | | | | |
| | | Repair | | | 1.0 | | | | |
| | Valves, Drain, Safety and Check | Replace | | 1.0 | | | | | |
| | | Repair | | | 1.5 | | | | |
| 1209 | Air Compressor Assembly | Service | | 0.3 | | | | 1 | |
| | | Replace | | | 2.0 | | | | |
| | | Repair | | | 4.0 | | | | |
| | | Overhaul | | | | 6.0 | | | |
| | Hose Assemblies | Replace | | | 1.0 | | | | |
| | Air Discharge System | | | | | | | 1 | |
| | Valve, Discharge | Replace | | | 2.0 | | | | |
| | Governor | Replace | | | 0.5 | | | 1 | |
| | | Repair | | | 1.0 | | | | |
| 13 | WHEELS AND TRACKS | | | | | | | | |
| 1311 | Wheel Assembly | Inspect | | 0.1 | | | | 1 | |
| | | Replace | | 0.2 | | | | | |
| | | Repair | | 0.8 | | | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 13 | WHEELS AND TRACKS – CONTINUED | | | | | | | | |
| 1313 | Tires, Tubes, Tire Chains | | | | | | | 1 | |
| | Tires | Service | 0.5 | | | | | | |
| | | Replace | | 2.0 | | | | | |
| 14 | STEERING | | | | | | | | |
| 1401 | Mechanical Steering Gear Assembly | | | | | | | 1 | |
| | Steering Wheel | Replace | | 0.6 | | | | | |
| | Steering Gear and Column | Service | | 0.2 | | | | | |
| | | Adjust | | | 1.0 | | | | |
| | | Replace | | | 3.0 | | | | |
| | | Repair | | | | 2.0 | | | |
| | | Overhaul | | | | 3.0 | | | |
| 1410 | Hydraulic Pump or Fluid Motor Assembly | | | | | | | 1 | |
| | Pump Assembly | Test | | | 0.7 | | | | |
| | | Service | | 0.2 | | | | | |
| | | Replace | | | 2.0 | | | | |
| | | Repair | | | | 3.0 | | | |
| | | Overhaul | | | | 4.0 | | | |
| 1411 | Hoses, Lines, and Fittings | Inspect | | 0.2 | | | | 1 | |
| | | Replace | | 1.0 | | | | | |
| 1412 | Hydraulic or Air Cylinders | | | | | | | 1 | |
| | Hydraulic Steering Cylinders | Test | | | 0.5 | | | | |
| | | Replace | | | 2.0 | | | | |
| | | Repair | | | | 2.0 | | | |
| | | Overhaul | | | | 3.0 | | | |
| 1414 | Steering System Valves | | | | | | | 1 | |
| | Steering Valves | Test | | | 0.5 | | | | |
| | | Service | | 0.5 | | | | | |
| | | Replace | | | 1.0 | | | | |
| | | Repair | | | | 1.0 | | | |
| | | Overhaul | | | | 2.0 | | | |
| | Demand Valve | Replace | | | 1.0 | | | | |
| | | Repair | | | | 1.5 | | | |
| | | Overhaul | | | | 3.0 | | | |
| 15 | FRAME, TOWING ATTACHMENTS, DRAWBARS | | | | | | | | |
| 1501 | Frame Assembly | | | | | | | 1 | |
| | Frame Assemblies, Front and Rear | Inspect | | 0.3 | | | | | |
| | | Replace | | | | 3.0 | | | |
| | | Repair | | | | 6.0 | | | |
| | Bolster | Replace | | | | 5.0 | | | |
| | | Repair | | | | 13.0 | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 15 | FRAME, TOWING ATTACHMENTS, DRAWBARS – CONTINUED | | | | | | | | |
| 1502 | Counterweights | Replace | | | | 2.0 | | 1 | |
| 18 | BODY, CAB, HOOD | | | | | | | | |
| 1801 | Body, Cab, and Hood Assemblies | | | | | | | 1 | |
| | Cab Assembly | Replace | | | 5.0 | | | | |
| | | Repair | | | 4.0 | | | | |
| | Hood | Replace | | | 2.0 | | | | |
| | Supports | Replace | | | 3.0 | | | | |
| 1802 | Fenders, Windshield, Glass, Etc. | | | | | | | 1 | |
| | Windshield Glass | Replace | | | 2.5 | | | | |
| | Glass | Replace | | | 2.0 | | | | |
| 1805 | Floors, Subfloors, and Related Parts | | | | | | | 1 | |
| | Plates | Replace | | | 2.0 | | | | |
| 1806 | Upholstery Seats and Carpets | | | | | | | 1 | |
| | Seat Assembly | Replace | | | 1.0 | | | | |
| | | Repair | | | 1.5 | | | | |
| 22 | BODY AND CHASSIS ITEMS | | | | | | | | |
| 2202 | Accessory Items | | | | | | | 1 | |
| | Heater Package | Replace | | 3.0 | | | | | |
| | | Repair | | 2.8 | | | | | |
| | Hose and Fittings, Heater and Defroster | Replace | | 1.0 | | | | | |
| | Wiper Motor Assemblies | Replace | | 2.0 | | | | | |
| | | Repair | | 1.0 | | | | | |
| | Back-Up Alarm Kit | Replace | | 1.5 | | | | | |
| | | Repair | | | 1.0 | | | | |
| | Blades | Replace | | 0.2 | | | | | |
| | Air Horn Assemblies | Test | | 0.2 | | | | | |
| | | Replace | | 0.2 | | | | | |
| | | Repair | | 0.5 | | | | | |
| | Air Horn Valve Assembly | Replace | | 0.3 | | | | | |
| | | Repair | | 0.5 | | | | | |
| | Blower Package | Replace | | 1.5 | | | | | |
| | | Repair | | | 1.8 | | | | |
| 2210 | Data Plates and Instruction Holders | | | | | | | 1 | |
| | Plates, Data | Replace | | 0.2 | | | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 24 | HYDRAULIC AND FLUID SYSTEMS | | | | | | | | |
| 2401 | Pump and Motor | | | | | | | 1 | |
| | Hydraulic Pump | Replace | | | 2.5 | | | | |
| | | Repair | | | | 1.5 | | | |
| | | Overhaul | | | | 2.0 | | | |
| 2402 | Manifold and/or Control Valves | | | | | | | 1 | |
| | Main Control Valves | Adjust | | | 1.0 | | | | |
| | | Replace | | | 2.0 | | | | |
| | | Repair | | | 1.5 | | | | |
| | | Overhaul | | | | 2.0 | | | |
| | Reservoir Relief Valve | Replace | | | 1.0 | | | | |
| | | Repair | | | | 1.5 | | | |
| | Control Valve | Test | | | 1.0 | | | | |
| | | Adjust | | | 1.0 | | | | |
| | | Replace | | | 2.0 | | | | |
| | | Repair | | | 1.5 | | | | |
| 2403 | Hydraulic Controls and/or Manual Controls | | | | | | | 1 | |
| | Levers | Replace | | 1.0 | | | | | |
| | | Repair | | 1.0 | | | | | |
| 2406 | Strainers, Filters, Lines and Fittings, Etc. | | | | | | | 1 | |
| | Hoses and Tubes | Replace | | | 0.3 | | | | |
| | Coupling Assemblies | Replace | | 0.2 | | | | | |
| | | Repair | | | 0.4 | | | | |
| 2407 | Hydraulic Cylinders | | | | | | | 1 | |
| | Boom Cylinder | Replace | | 1.0 | | | | | |
| | | Repair | | | 2.0 | | | | |
| | | Overhaul | | | | 2.5 | | | |
| | Bucket Cylinders | Replace | | | 1.5 | | | | |
| | | Repair | | | 3.0 | | | | |
| | Hydraulic Air Cylinders | Replace | | | 2.0 | | | | |
| 2408 | Liquid Tanks or Reservoirs | | | | | | | 1 | |
| | Reservoir Assemblies | Service | | 1.0 | | | | | |
| | | Replace | | | 2.0 | | | | |
| | | Repair | | | | 2.0 | | | |
| 47 | GAGES (NON ELECTRICAL), WEIGHING AND MEASURING DEVICES | | | | | | | | |
| 4702 | Gages, Mountings, Lines, and Fittings | | | | | | | 1 | |
| | Pressure, Gage and Indicator | Test | | 0.5 | | | | | |
| | | Replace | | 1.0 | | | | | |
| | Gage, Dial Pressure and Hydraulic Pressure | Test | | 0.5 | | | | | |
| | | Replace | | | 1.0 | | | | |

## MAINTENANCE ALLOCATION CHART – CONTINUED

| (1) Group number | (2) Component/Assembly | (3) Maintenance function | (4) Maintenance category C | O | F | H | D | (5) Tools and eqpt | (6) Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 47 | GAGES (NON ELECTRICAL), WEIGHING AND MEASURING DEVICES – CONTINUED | | | | | | | | |
| 4702 | Gages, Mountings, Lines, and Fittings – Continued | | | | | | | | |
| | Tachometer Kit | Replace | | | 1.0 | | | 1 | |
| 74 | CRANES, SHOVELS, AND EARTH MOVING EQUIPMENT COMPONENTS | | | | | | | | |
| 7436 | Lift Arms and Pivot Assemblies | | | | | | | | |
| | Boom, Left and Right | Replace | | | 4.0 | | | 1 | |
| 7437 | Loader Bucket Assembly or Forklift | | | | | | | | |
| | Bucket Assemblies | Replace | | 2.0 | | | | 1 | |
| | | Repair | | 4.0 | | | | | |
| | Bucket Shanks | Replace | | 0.2 | | | | | |
| | Bucket Tips | Replace | | 0.2 | | | | | |
| 7439 | Circle Reverse Drawbar Side Shift and Lift Mechanism | | | | | | | | |
| | Boom Positioner | Replace | | | 3.5 | | | 1 | |
| | Control Valve | Repair | | | 1.5 | | | | |

## Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

| (1) Tool or test equipment ref code | (2) Maintenance category | (3) Nomenclature | (4) National stock number | (5) Tool number |
|---|---|---|---|---|
| | | NOTE<br>Unless otherwise noted, all maintenance functions can be accomplished with tools contained in the following common tool sets. | | |
| 1 | O | Tool Kit Auto Maint: Org Maint. Common #1 | 4910-00-754-0654 | SC4910-95CLA74 (19204) |
| 2 | O | Timing Wrench for Hand Cranking | See Page 20 Sec. 8 of Operators Manual | Fabricate |
| 1 | O | Tool Kit Auto Mech: Light Weight | 5180-00-177-7033 | SC5180-90-CL-N26 (50980) |
| 1 | F | Shop Equip Contact Maint Truck Mounted | 4940-00-294-9518 | MILS4855 (81349) |

## Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

| (1) Tool or test equipment ref code | (2) Maintenance category | (3) Nomenclature | (4) National stock number | (5) Tool number |
|---|---|---|---|---|
| 1 | F | Shop Equip Gen Purp Repair Semitrlr Mtd | 4940-00-287-4894 | MILS45538 (81349) |
| 1 | F | Shop Equip Org Repair Light Truck Mtd | 4940-00-294-9516 | MILS45537 (81349) |
| 1 | F | Tool Kit Automotive Fuel and Elec Sys Repair | 5180-00-754-0655 | SC4910-95CLA50 (19204) |
| 1 | F | Tool Kit Auto Maint: Org. Maint. Common #2 | 4910-00-754-0650 | SC4910-95CLA72 (19204) |
| 1 | F | Tool Kit Master Mech: Equip Maint & Repair | 5180-00-699-5273 | SC5180-90-CL-N05 (50980) |
| 1 | F | Wrench Set Socket: 3/4" Drive Hex Type | 5130-00-357-5135 | A-A-399A (58536) |
| 1 | F | Wrench Torque: 3/4" Drive 100 - 500 lb Capacity | 5120-00-542-5577 | 6017F (47805) |
| 1 | F | Shop Eqp. Fuel & Elec Sys Engine | 4940-00-754-0714 | SC4910-95CLA01 (19204) |
| 1 | F | Shop Set Fuel & Elec Sys. | 4940-00-390-7775 | SC4910-95CLA65 (19204) |
| 1 | F | Test Set Dsl Inj | 4910-00-317-8265 | 5910359 (19204) |
| 1 | F | Shop Eqp. Auto Maint. & Rpr Org. Suppl. No-1 Less Power | 4910-00-754-0653 | SC4910-95CLA73 (19204) |
| 1 | F | Shop Eqp Machine Shop | 3740-00-754-0708 | SC4370-95CLA02 (19204) |
| 1 | F | Tool Kit Machinist | 5280-00-511-1950 | SC5280-95CLA02 (19204) |
| 1 | F | Shop Eqp Welding | 4940-00-357-7268 | SC3470-95CLA08 (19204) |
| 1 | F | Tool Kit Body and Fender Repair | 5180-00-754-0643 | SC5180-90CLN34 (50980) |
| 1 | F | Multimeter | 6625-00-999-7465 | SCDL551651 (80063) |
| 3 | F | Vibration Damper Hob with Wear Sleeve & Damper | | PLT-542 |
| 4 | F | Fan Drive Pulley Puller | | PLT-506 |
| 5 | F | Torque Wrench, 2500 Ft Lb Model PD2501 | 5120-00-482-2543 | PD2501 (92059) |

## TOOL AND TEST EQUIPMENT REQUIREMENTS – CONTINUED

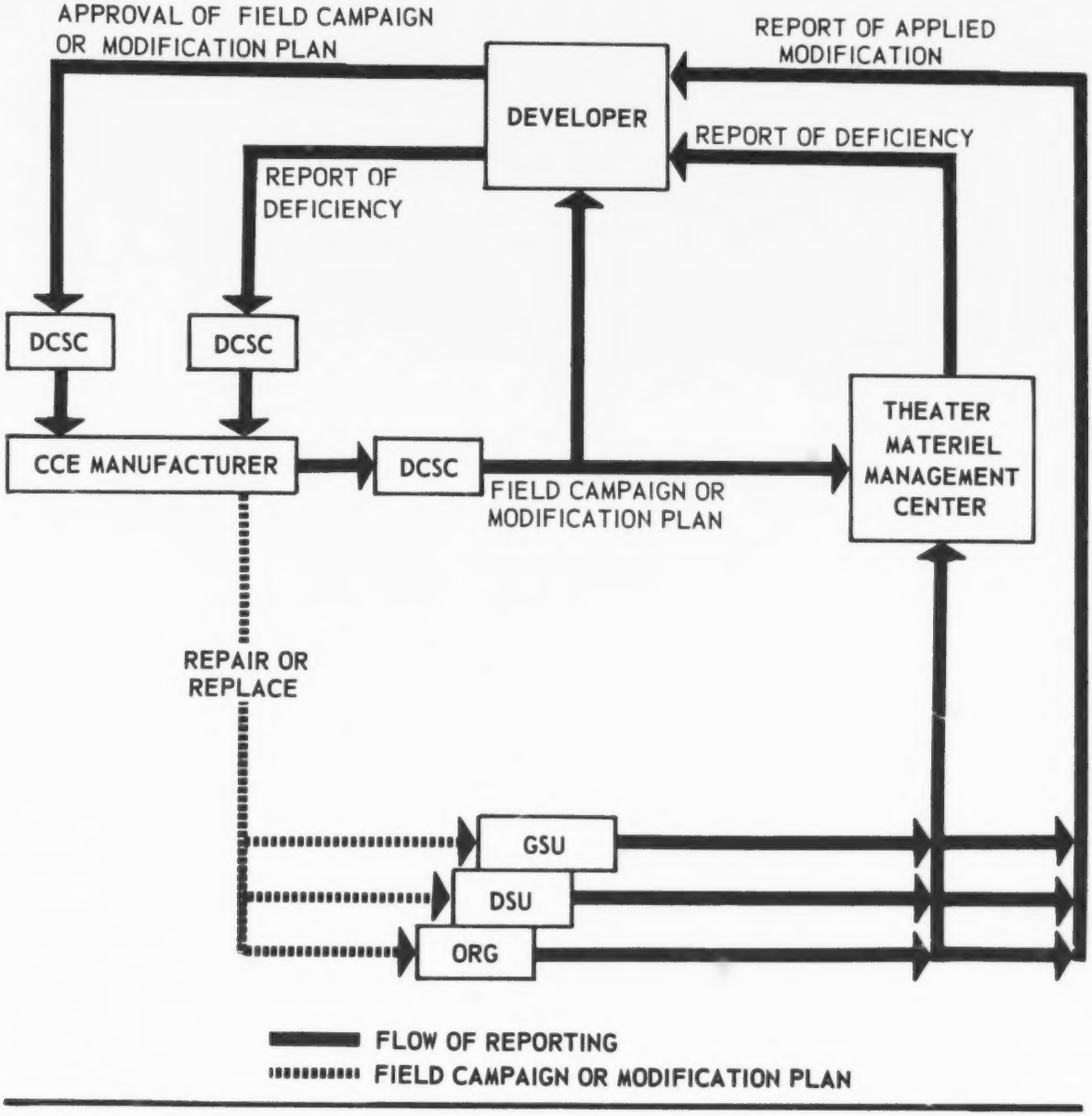
| (1) Tool or test equipment ref code | (2) Maintenance category | (3) Nomenclature | (4) National stock number | (5) Tool number |
|---|---|---|---|---|
| 6 | F | Spring Load Tester Valve & Clutch Spring Tester | | PLT-100 |
| 7 | F | Lifting Eye | See Page 48 Fig 4-110 Sec. 4 of Service Manual SM-H100C | Fabricate |
| 8 | F | Lifting Tool | See Page 49 Fig 4-111 Sec. 4 of Service Manual SM-H100C | Fabricate |
| 9 | F | Differential Holding Fixture | See Page 33 Sec. 6 Fig 6-61 of Service Manual SM-H100C | Fabricate |
| 10 | F | Fan Pulley Holding Fixture | See Page 6 Sec. 6 Fig #10 Engine Manual SM-817C-1 | Fabricate |
| 11 | H | Conn Rd Bushing Removal and Installing Tool | | PLT-544-1 |
| 12 | H | Crank Shaft Gear Nut Torque Wrench Adapter | | PLT-518 |
| 13 | H | Injector Sleeve Puller | | PLT-507-3 |
| 14 | H | Injector Sleeve Bottom Tool | | PLT-507-4 |
| 15 | H | Injector Rolling Sleeve | | PLT-507-1 |
| 16 | H | Injector Sleeve Reamer and Guide Bushing | | PLT-507-2 |
| 17 | H | Cyl Sleeve Puller | | PLT-502-3 |
| 18 | H | Rear Crane Shaft Oil Seal | | PLT-513-7A |
| 19 | H | Compression Test Adapter | | PLT-521-8 |
| 20 | H | Cylinder Head Water Test Kit | | PLT-508 |
| 21 | H | Adapter for Pressure Testing Valve Housing to Injection Nozzle Lines | Part of PLT-365-2 6635-01-144-9000 | 4092 (75384) |
| 22 | H | Snap Ring Groove Filler | See Page 50 Fig 4-112 Sec. 4 of Service Manual SM-H100C | Fabricate |
| 23 | H | Axle Remover & Installer | See Page 33 Sec. 6 Fig 6-60 of Service Manual SM-H100C | |

## Section IV. REMARKS

| (1) Reference code | (2) Remarks |
|---|---|
| | Not Applicable |

# APPENDIX D

## CCE MANUFACTURER FIELD CAMPAIGNS AND MODIFICATION PROCEDURES




TA 162338

# APPENDIX E
# BASIC ISSUE ITEMS LIST

| National stock number | Description | Unit of meas | Qty furn with equip |
|---|---|---|---|
| 7520–00–559–9618 | Case Maintenace and Operational Manual | Each | 1 |
| 7510–00–889–3494 | Binder, Log Book | Each | 1 |

# APPENDIX F

# INITIAL RECOMMENDATION PRESCRIBED LOAD LIST (PLL) AUTHORIZED STOCKAGE LIST (ASL)

| SMR code | National stock number | Part number | FSCM | Description | U/M | Qty of parts req'd for no. of end items | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PLL | ASL | | |
| | | | | | | 1-5 | 1-5 | 6-20 | 21-50 |
| PAOZZ | 2910-00-470-7075 | 235569 | 73370 | Filter, Primary Fuel | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 2910-00-001-6176 | X240668 | 73370 | Filter, Final Fuel | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 4720-00-008-7263 | 188013H1 | 29510 | Hose Preformed Radiator | EA | 1 | 2 | 3 | 4 |
| PAOZZ | 4330-00-008-1758 | 896811-C1 | 92679 | Element, Oil Torque Converter | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 6240-00-044-6914 | 1683 | 08108 | Lamp, Stop | EA | 1 | 2 | 4 | 4 |
| PAOZZ | 6240-00-643-0687 | 4578 | 08108 | Lamp, Flood | EA | 1 | 2 | 4 | 4 |
| PAOZZ | 6240-00-019-3093 | 623 | 08108 | Lamp, Tail | EA | 1 | 2 | 4 | 4 |
| PAOZZ | 5930-00-738-5555 | 92104 | 13445 | Switch, Neutral | EA | 1 | 2 | 3 | 4 |
| PAOZZ | 5930-00-849-0973 | 8640 | 13445 | Switch, Pressure | EA | 1 | 2 | 3 | 4 |
| PAOZZ | 2920-01-060-8770 | 248403 | 13445 | Switch, Master | EA | 1 | 2 | 3 | 4 |
| PAOZZ | 2940-00-891-0748 | 234049 | 73370 | Element Hydraulic Filter | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 3830-01-006-2980 | 882845C91 | 29510 | Valve Relief Air | EA | 1 | 2 | 3 | 4 |
| PAOZZ | 2940-01-064-3916 | CD1628500826 | 00736 | Element, Air Cleaner | EA | 1 | 3 | 6 | 6 |
| PAOZZ | | 2283 | 00736 | Washer Seal Air Cleaner | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 2940-01-061-0763 | CD1628500827 | 00736 | Element, Air Cleaner Safety | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 2940-01-061-4933 | 6684858 | 81321 | Filter Oil | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 5330-01-060-9311 | 6693625 | 81321 | Gasket, Filter | EA | 1 | 3 | 6 | 6 |
| PAOZZ | 5310-00-234-5143 | 217164H1 | 29510 | Nut, Wheel | EA | 21 | 42 | 84 | 84 |
| PAOZZ | 5307-01-060-9125 | 217146H2 | 29510 | Stud, Wheel | EA | 21 | 42 | 84 | 84 |
| PAOZZ | 5330-01-061-1643 | 25021R1 | 29510 | Packing, Preform, Torque Converter | EA | 2 | 6 | 12 | 12 |
| PAOZZ | 5330-00-143-8463 | 250003 | 92863 | Seak, Housing, Torque Converter | EA | 1 | 3 | 6 | 6 |

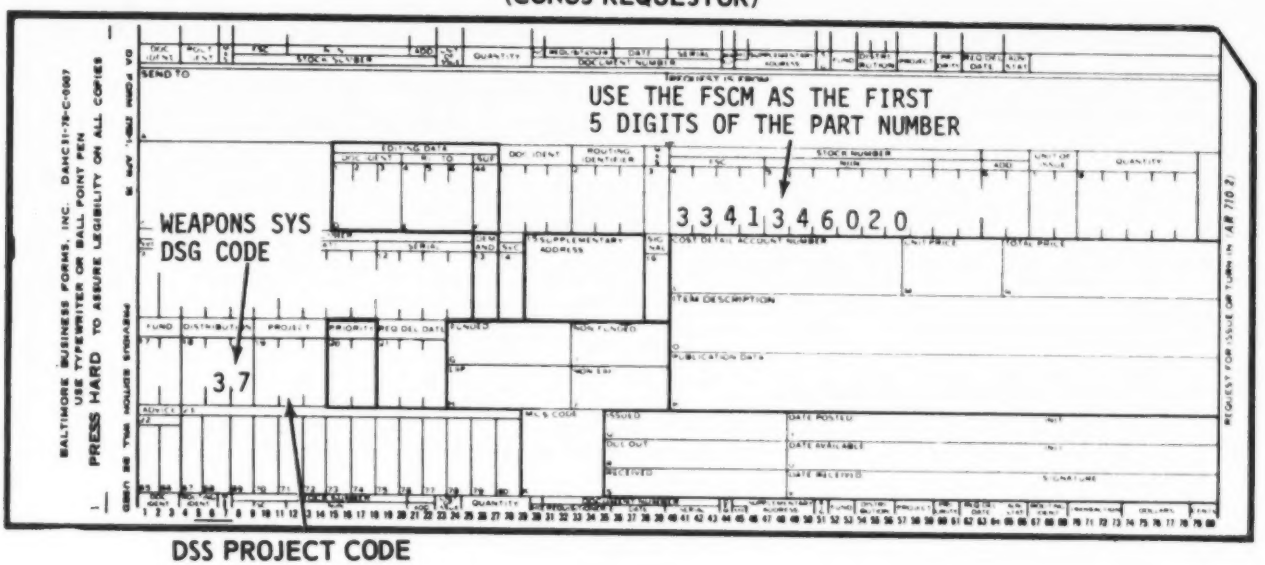
# APPENDIX G

## SAMPLE FORMAT

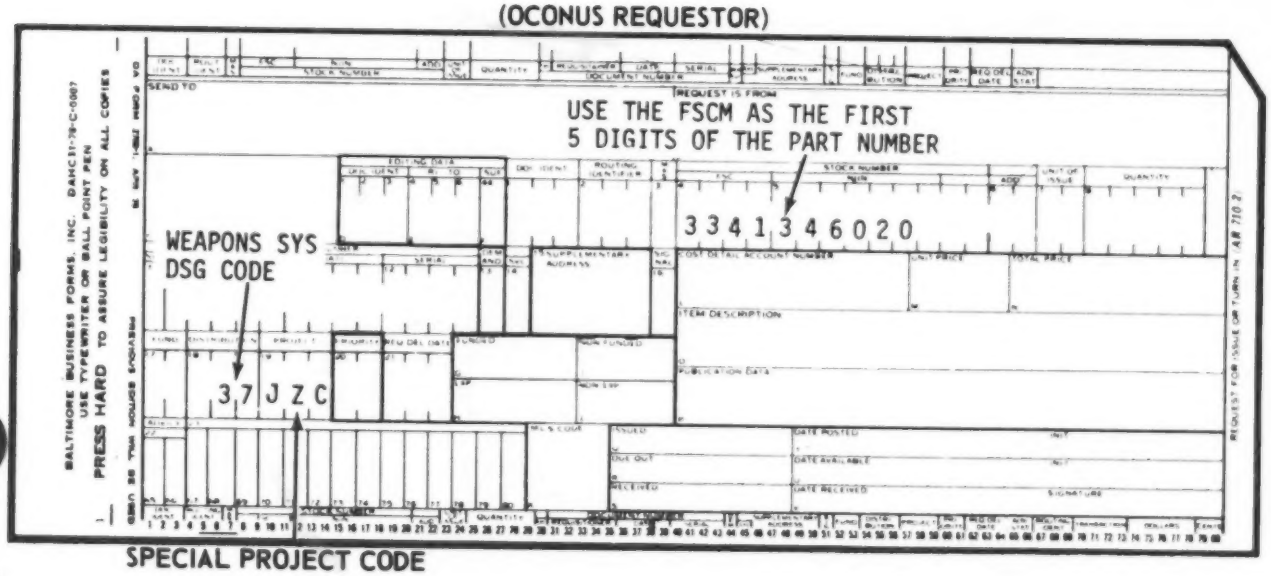
## -

## DA FORM 2765 PART NUMBER REQUEST

(CONUS REQUESTOR)



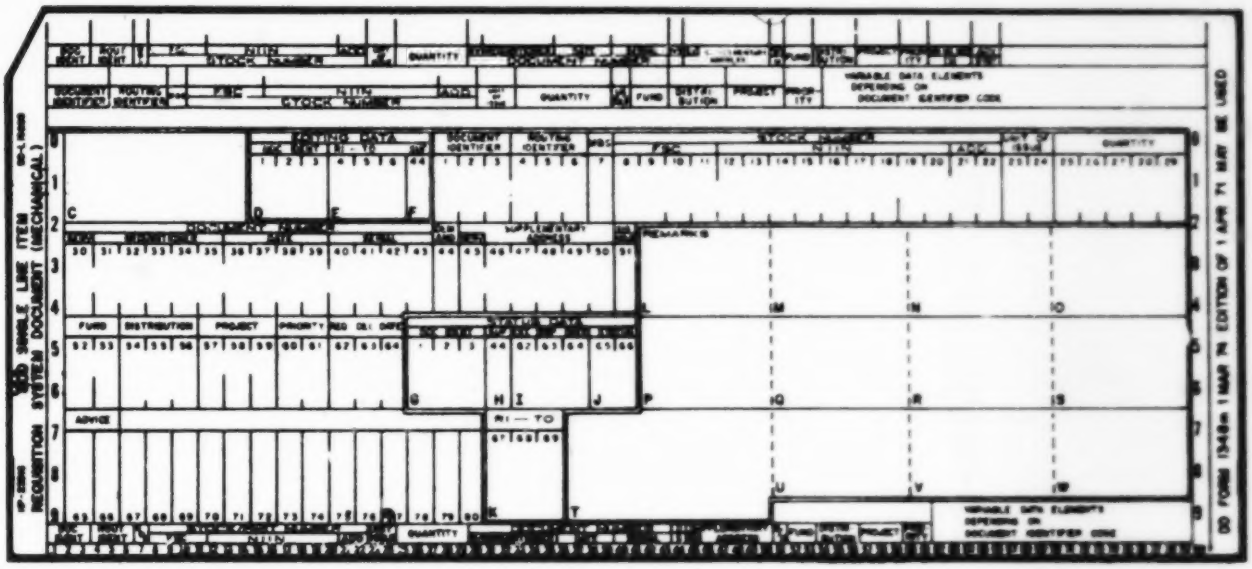

(OCONUS REQUESTOR)




TA 126340

# APPENDIX H

## SAMPLE FORMAT - MILSTRIP REQUISITION FOR CCE (NSN)

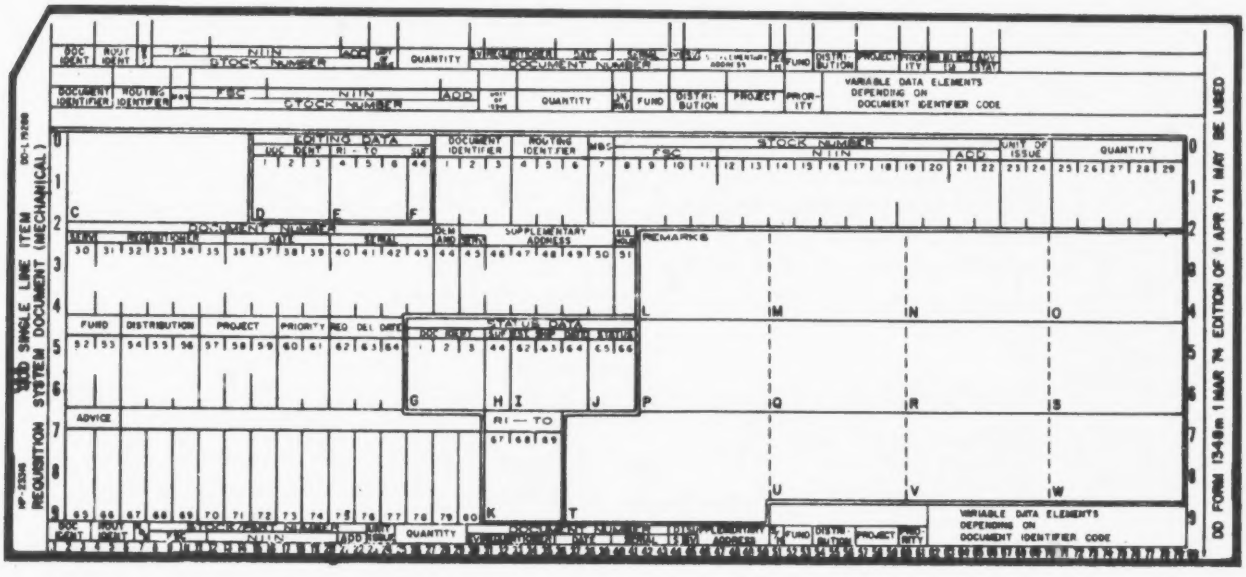


| CARD COLUMN | DESCRIPTION OF DATA | MANDATORY ENTRY FOR CCE |
|---|---|---|
| 1-3 | Document Identifier Code | AØA - CONUS<br>AØ1 - Overseas |
| 4-6 | Routing Identifier Code | |
| 7 | Media/Status Code | |
| 8-22 | NSN | |
| 23-24 | Unit of Issue | |
| 25-29 | Quantity | |
| 30-43 | Document Number | |
| 44 | Demand Code | |
| 45-50 | Supplementary Address | |
| 51 | Signal Code | |
| 52-53 | Fund Code | |
| 54-56 | Distribution Code CC-54 | "F" for CONUS; see AR 725-50 for OCONUS |
| | CC-55-56 | Weapon System Code (DSS) Code |
| 57-59 | Project Code | |
| 60-61 | Priority Code | |
| 62-64 | Required Delivery Date | |
| 65-66 | Advice Code | |

TA 126334

# APPENDIX I

## SAMPLE FORMAT - MILSTRIP REQUISITION FOR CCE (NON-NSN)




| CARD COLUMN | DESCRIPTION OF DATA | MANDATORY ENTRY FOR CCE |
|---|---|---|
| 1-3 | Document Identifier Code | AØB - CONUS<br>AØ2 - Overseas |
| 4-6 | Routing Identifier Code | Always S9C |
| 7 | Media/Status Code | |
| 8-22 | FSCM and Part Number | |
| 23-24 | Unit of Issue | |
| 25-29 | Quantity | |
| 30-43 | Document Number | |
| 44 | Demand Code | |
| 45-50 | Supplementary Address | |
| 51 | Signal Code | |
| 52-53 | Fund Code | |
| 54-56 | Distribution Code CC-54 | "F" for CONUS; see AR 725-50 for OCONUS |
| | CC-55-56 | Weapon System Code |
| 57-59 | Project Code | CCE (DSS) Code |
| 60-61 | Priority Code | |
| 62-64 | Required Delivery Date | |
| 65-66 | Advice Code | |

TA 1126335

## APPENDIX I — Continued

| CARD COLUMN | DESCRIPTION OF DATA | MANDATARY ENTRY FOR CCE |
|---|---|---|
| 67–69 | Blank | |
| 70 | Identification code applicable to entry in cc 71–80. | |
| | A — Technical order or Technical Manual | |
| | B — End Item Identification | |
| | C — Noun Description | |
| | D — Drawing or Specification No. | |
| 71–80 | Reference Identification | Identification of reference specified in cc 70 |

# APPENDIX J

## SAMPLE FORMAT - MILSTRIP REQUISITION FOR CCE (NON-NSN) (MANUAL)

| DOCUMENT IDENTIFIER | ROUTING IDENTIFIER | M&S | MANUFACTURER'S CODE * AND PART NUMBER | | UNIT OF ISSUE | QUANTITY | DOCUMENT NUMBER | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | FSCM | PART NUMBER | | | SERV | REQUISITIONER | DATE | SERIAL |
| 1 2 3 | 4 5 6 | 7 | 8 9 10 11 12 | 13 14 15 16 17 18 19 20 21 22 | 23 24 | 25 26 27 28 29 | 30 31 | 32 33 34 35 36 | 37 38 39 40 | 41 42 43 |
| | | | | | | | | | | |

| DEMAND | SUPPLEMENTARY ADDRESS SERV | | SIGNAL | FUND CODE | DISTRIBUTION CODE | PROJECT CODE | PRIORITY | REQUIRED DELIVERY DATE | ADVICE CODE | BLANK | | REJECT CODE (FOR USE BY SUPPLY SOURCE ONLY) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | 45 46 47 48 49 50 | | 51 | 52 53 | 54 55 56 | 57 58 59 | 60 61 | 62 63 64 | 65 | 66 67 68 69 | 70 71 72 73 74 75 76 77 78 79 80 | 65 | 66 |
| | | | | | | | | | | | | | |

**IDENTIFICATION DATA**

| | |
|---|---|
| * 1. MANUFACTURER'S CODE & PART NO. *(When they exceed Card Columns 8 thru 22)* | 2. MANUFACTURER'S NAME |
| 3. MANUFACTURER'S CATALOG IDENTIFICATION AND DATE | 4. TECHNICAL ORDER NUMBER |
| 5. TECHNICAL MANUAL NUMBER | 6. NAME OF ITEM REQUESTED |
| 7. DESCRIPTION OF ITEM REQUESTED | 7a. COLOR<br>7b. SIZE |
| 8. END ITEM APPLICATION AND SOURCE OF SUPPLY | |
| 8a. MAKE | 8b. MODEL NUMBER / 8c. SERIES / 8d. SERIAL NUMBER |
| 9. REQUISITIONER *(Clear Text Name and Address)* | 10. REMARKS |

FOLD LINE FOLD LINE

DD FORM 1 APR 77 1348-6 EDITION OF 1 MAR 74 MAY BE USED UNTIL EXHAUSTED

**NON-NSN REQUISITION *(MANUAL)***

TA 126336

## APPENDIX J - Continued

### INSTRUCTIONS

This form will only be used in those cases where the manufacturer's code and part number exceed the spaces allocated in card columns 8 - 22 of the requisition.

| COLUMN CARD | DESCRIPTION OF DATA | MANDATORY ENTRY FOR CCE |
|---|---|---|
| 1 - 3 | Document Identifier Code | AØE - CONUS<br>AØ5 - OVERSEAS |
| 4 - 6 | Routing Identifier Code | Always S9C |
| 7 | Media Status Code | |
| 8 - 22 | FSCM and Part Number | Leave Blank<br>Enter in Block 1 under Identification Data |
| 23 - 24 | Unit of Issue | |
| 25 - 29 | Quantity | |
| 30 - 43 | Document Number | |
| 44 | Demand Code | |
| 45 - 50 | Supplementary Address | |
| 51 | Signal Code | |
| 52 - 53 | Fund Code | |
| 54 - 56 | Distribution Code CC-54 | "F" for CONUS. (See AR 725-50 for overseas). |
| | CC-56 | Weapon System Code |
| 57 - 59 | Project Code | Appropriate CCE Project Code |
| 60 - 61 | Priority Code | |
| 62 - 64 | Required Delivery Date | |
| 65 - 66 | Advice Code | |
| 67 - 80 | | Blank |

**IDENTIFICATION DATA – Lower half of DD Form 1348-6, complete blocks 1 thru 9.**

TA 162337

# APPENDIX K

# MAINTENANCE AND OPERATING SUPPLY LIST

| Component application | Mfr part no or Nat'l stock no. | Description | Qty req F/Initial opn | Qty req F/8 hrs opn | Notes |
|---|---|---|---|---|---|
| Engine | 9150-00-186-6681 | MIL-L-2104C 30W 1 qt. | 8.5 gal | | 9150-00-188-9858 (30W 5 Gal.) |
| Transmission | 9150-00-186-6668 | MIL-L-2104C 10W 5 gal. | 11.4 gal | | 9150-00-191-2772 (10W 55 Gal.) |
| Torque Converter | 9150-00-186-6668 | MIL-L-2104C 10W 5 gal. | 11.4 gal | | 9150-00-191-2772 (10W 55 Gal.) |
| Hydraulic System | 9150-00-186-6668 | MIL-L-2104C 10W 5 gal. | 11.4 gal | | 9150-00-191-2772 (10W 55 Gal.) |
| Differentials & Planetaries | 9150-00-577-5841 | MIL-L-21050 80W 55 gal. | 12.0 gal | | 9150-00-001-9395 (90W 5 Gal.) |
| Grease Lubrication Points | 9150-00-190-0904 | MIL-G-10924B 1 lb. | As req. | | |
| Brake Master Cylinder | 9150-00-231-9071 | Brake Fluid VV-B-680 SAEJ1703 (70R3) | As req. | As req. | |

# APPENDIX L
# PREVENTIVE MAINTENANCE CHECKS AND SERVICES

## L-1. Maintenance Forms and Records

Every mission begins and ends with the paperwork. There isn't much of it, but you have to keep it up. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your vehicle. They are reports to organizational maintenance and to your commander and they are a checklist for you when you want to know what is wrong with the vehicle after its last use, and whether those faults have been fixed. For the information you need on forms and records, see TM 38-750.

## L-2. Preventive Maintenance Checks and Services

*a.* Do your (B) PREVENTIVE MAINTENANCE just before you operate the vehicle. Pay attention to the CAUTIONS and WARNINGS.

*b.* Do your (D) PREVENTIVE MAINTENANCE during operation. (During operation means to monitor the scooploader and its related components while they are actually being operated).

*c.* Do your (A) PREVENTIVE MAINTENANCE right after operating the vehicle. Pay attention to the CAUTIONS and WARNINGS.

*d.* Do your (W) PREVENTIVE MAINTENANCE weekly.

*e.* Do your (M) PREVENTIVE MAINTENANCE once a month.

*f.* If something doesn't work, troubleshoot it with the instructions in this manual or notify your supervisor.

*g.* Always do your PREVENTIVE MAINTENANCE in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

*h.* If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to organizational maintenance RIGHT NOW.

*i.* When you do your PREVENTIVE MAINTENANCE, take along the tools you need to make all the checks. You always need a rag or two.

**WARNING**

Drycleaning solvent, SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138°F.

(1) *Keep it clean:* Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (SD-2) on all metal surfaces. Use soap and water when you clean rubber or plastic material.

(2) *Bolts, nuts, and screws:* Check them all for obvious looseness, missing, bent or broken condition. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, tighten it, or report it to organizational maintenance if you can't tighten it.

(3) *Welds:* Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to organizational maintenance.

(4) *Electric wires and connectors:* Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape.

(5) *Hoses and fluid lines:* Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, of course. But a stain around a fitting or connector can mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to organizational maintenance.

*j.* It is necessary for you to know how fluid leakage affects the status of your vehicle. The following are definitions of the types/classes of leakage an operator or crew member needs to know to be able to determine the status of his/her vehicle. Learn, then be familiar with them and REMEMBER — WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR!

Leakage Definitions for Crew/Operator PMCS

Class I Seepage of fluid (as indicated by wet-

ness or discoloration) not great enough to form drops.

Class II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

Class III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

**CAUTION**

**Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.**

*Table L-1. Operator/Crew Preventive Maintenance Checks and Services*

B–Before D–During A–After W–Weekly M–Monthly

| Item No. | Interval B | D | A | W | M | ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed | Equipment is not ready/ available if: |
|---|---|---|---|---|---|---|---|
| | | | | | | NOTE<br>Perform weekly as well as before PMCS's if: | |
| | | | | | | a. You are the assigned operator but have not operated equipment since last weekly. | |
| | | | | | | b. You are operating the equipment for the first time. | |
| 1. | | | | | | Make the following walk-around checks: (Exterior of Vehicle) | |
| | • | | | | | a. Check for evidence of leakage (oil, fuel, hydraulic fluid or coolant) on or under the scooploader. | Class III leakage is evident. No fuel leaks allowed. |
| | • | | | | | b. Visually check for loose, missing or damaged parts. | |
| | • | | | | | c. Check tires for obvious damage or low pressure (correct pressure is 45-50 psi). | Tires have cuts or abrasions which could cause tire failure during operation. One or more tires missing or unserviceable. |
| 2. | • | | | | | RADIATOR<br>Check coolant level. Remove radiator cap; coolant should be approximately 1 inch above baffle. Add as required. | |
| 3. | • | | | | | BELTS<br>Inspect fan and alternator belts for frayed condition or deterioration. | Belt missing or broken. |
| 4. | • | | | | | ENGINE<br>Check oil level with dipstick. Add as required to "Full" mark. | |
| 5 | • | | | | | AIR CLEANER<br>Check air cleaner service indicator. Clean or replace element when red stripe completely fills indicator window. | |
| 6. | • | | | | | ALCOHOL EVAPORATOR (if equipped-cold weather operation only)<br>Check level of alcohol at filler cap. Add methyl alcohol as necessary. | |
| 7. | | • | | | | TRANSMISSION<br>Check fluid level at dipstick with engine running at operating temperature and transmission in neutral. Level should be between "L" and "H". Add as required. | |
| 8. | | • | | | | BRAKES<br>Check brakes for proper operation. | Improper operation is evident. |

*Table L-1. Operator/Crew Preventive Maintenance Checks and Services* — Continued

| Item No. | Interval B | D | A | W | M | ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed | Equipment is not ready/ available if: |
|---|---|---|---|---|---|---|---|
| 9. | | • | | | | LIGHTS<br>Check lights for proper operation. | |
| 10. | | • | | | | BACK-UP ALARM<br>Check back-up alarm for proper operation. | |
| 11. | | • | | | | WINDSHIELD WIPERS<br>Check windshield wiper for proper operation. | |
| 12. | | | | | | INSTRUMENTS<br>Check for normal operating readings as follows: | Instruments do not register in proper operating range. |
| | | ▪ | | | | a. Torque Converter<br>Oil Temperature Gage ..... Green Area | |
| | | • | | | | b. Fuel Pressure Gage ..... Green Area | |
| | | • | | | | c. Air Preasure Gage ..... Green Area | |
| | | • | | | | d. Engine Oil Pressure Gage<br>Low idle ..... Idle Range<br>Normal Range ..... Green Area | |
| | | • | | | | e. Engine Coolant Temperature ..... Green Area | |
| | | • | | | | f. Voltmeter<br>Low idle ..... Left Green Area<br>Normal Range ..... Right Green Area | |
| 13. | | | • | | | HYDRAULIC SYSTEM<br>Check fluid level at filler cap with oil at operating temperature, engine shut down and bucket lowered. Level should be at "H". Add as required. | |
| 14. | | | | | | PRECLEANER HOOD AND DUST UNLOADER VALVE | |
| | | | • | | | a. Clean precleaner screen. | |
| | | | ▪ | | | b. Squeeze dust unloader valve to remove accumulated dust. | |
| 15. | | | • | | | AIR TANKS<br>Open air tank drain valves a maximum of two turns to drain accumulated water. Close after air has drained. | |
| 16. | | | | • | | BATTERIES | |

*Table L-1. Operator/Crew Preventive Maintenance Checks and Services* — Continued

| Item No. | Interval B | D | A | W | M | ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed | Equipment is not ready/ available if: |
|---|---|---|---|---|---|---|---|
| | | | | | | WARNING<br><br>Do not smoke or allow open flame in vicinity while checking or filling battery. The battery generates hydrogen, a highly explosive gas. | |
| | | | | | | Check level of electrolyte. If low, fill with clean water (distilled if possible) to 1/4 inch above plates. In freezing weather, run engine at least 15 minutes to allow added water to mix with electrolyte. | |
| 17. | | | | | | LUBRICATION<br><br>Lubricate the following lubrication points with MPG grease: | |
| | | | | • | | a. Boom pivots | |
| | | | | • | | b. Bucket cylinder | |
| | | | | • | | c. Bucket links | |
| | | | | • | | d. Bucket pivots | |
| | | | | • | | e. Steering cylinders | |
| | | | | • | | f. Boom cylinders | |
| | | | | • | | g. Bellcrank pivots | |
| | | | | • | | h. Axle cradle | |
| | | | | • | | i. Drag links | |
| | | | | • | | j. Drive shafts | |
| | | | • | | | k. Center hinge pins | |

## L-3. Organizational Preventive Maintenance Checks and Services

*a.* Perform the checks and services at the intervals shown in table L-2.

(1) Do the (Q) checks and services once each three months.

(2) Do the (S) checks and services twice a year, or each six months.

(3) Do the (A) checks and services once each year.

(4) Do the (B) checks and services once each two years.

(5) Do the (H) checks and services at the hour interval listed.

(6) Do the (MI) checks and services when the mileage of the vehicle reaches the amount listed.

*b.* If the Scooploader doesn't work properly and you can't see what is wrong, troubleshoot it with the instructions in this manual or notify your supervisor.

**WARNING**

Drycleaning solvent SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138°F.

*c.* Make cleanup a part of your preventive maintenance. Dirt, grease, oil, and debris may cover up a serious problem. Use drycleaning solvent (SD-2) to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

*d.* Watch for and correct anything that might cause a problem with the semitrailer. Some things to watch for are:

(1) Bolts, nuts, and screws that are loose, missing, bent, or broken.

(2) Welds that are bad or broken.

(3) Electric wires and connectors that are bare, broken, or loose.

*e.* You should know how fluid leaks affect the status of your equipment. Learn and be familiar with the following definitions of the types/classes of leakage. Leakage definitions for PMCS are:

Class I Seepage of fluid (indicated by wetness or discoloration) not great enough to form drops.

Class II Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.

Class III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

**CAUTION**

Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

Class III leaks should be corrected before releasing equipment for operation.



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*Table L–2. Organizational Preventive Maintenance Checks and Services*

Legend

Q–Quarterly S–Semiannually A–Annually B–Biennially H–Hours MI–Miles

| Item No. | Interval | | | | | | ITEM TO BE INSPECTED<br>Procedure |
|---|---|---|---|---|---|---|---|
| | Q | S | A | B | H | MI | |
| | | | | | | | NOTE<br>Perform Operator/Crew PMCS prior to or in conjunction with organizational PMCS. |
| 1 | | | | | | | HYDRAULIC RESERVIOR |
| | | | | | 100 | | a. Remove breather, clean, inspect, and reinstall. |
| | | | | | 1000 | | b. Change oil and filter. |
| 2 | | | | | | | POWER BRAKES |
| | | | | | 100 | | a. Check power brake cluster level, Level should be approximately 3/8 — 1/2 inch below top of housing. Add as required. |
| | | | | | 100 | | b. Clean and reinstall brake cluster breather. |
| | | | | | 200 | | c. Check brakes for wear. |
| 3 | | | | | | | WHEEL LUG NUTS |
| | | | | | | | Check torque (875-925 lb-ft.) |
| 4 | | | | | | | TRANSMISSION |
| | | | | | 100 | | a. Clean and reinstall breather. |
| | | | | | 500 | | b. Change filter and clean strainer. |
| | | | | | 1000 | | c. Change oil and filter. |
| 5 | | | | | | | LUBRICATION |
| | | | | | 100 | | a. Lubricate drive shaft with grease (MPG). |
| | | | | | 100 | | b. Check steering gear lubricate. Level should be even with capscrew hole. Add as required. |
| | | | | | 5000 | | c. Lubricate engine cranking motor (10W oil). |
| | | | | | 1000 | | d. Lubricate control lever pivot points. |
| 6 | | | | | | | AIR SYSTEM |
| | | | | | 200 | | Check for and correct any leaks. |
| 7 | | | | | | | V-BELTS |
| | | | | | 200 | | a. Check for broken, frayed or worn belts. |
| | | | | | 200 | | b. Check tension. Proper deflection is 29/32 inch for alternator belt and 13/16 inch for air compressor or belt, midway between pulleys. |
| 8 | | | | | | | ENGINE CRANKCASE |
| | | | | | 200 | | a. Clean crankcase breather. |
| | | | | | 200 | | b. Change oil and filters. |

*Table L-2. Organizational Preventive Maintenance Checks and Services* — Continued

Legend

Q–Quarterly S–Semiannually A–Annually B–Biennially H–Hours MI–Miles

| Item No. | Interval | | | | | | ITEM TO BE INSPECTED Procedure |
|---|---|---|---|---|---|---|---|
| | Q | S | A | B | H | MI | |
| 9 | | | | | | | AXLES |
| | | | | | 100 | | a. Check oil level. Level should be even with filler plug hole. Add as required. |
| | | | | | 1000 | | b. Change oil. |
| 10 | | | | | | | WIRING |
| | | | | | 200 | | Check for worn, cracked, or frayed insulation, broken wires, loose or corroded connections. |
| 11 | | | | | | | FUEL TANK |
| | | | | | 200 | | Drain water and sediment |
| 12 | | | | | | | RADIATOR |
| | | | | | 100 | | Change coolant (refer to TB 750-651). |
| 13 | | | | | | | INTERMEDIATE DRIVE BLOCK |
| | | | | | 100 | | a. Check oil level. Dipstick should indicate "Full." Add as required. |
| | | | | | 1000 | | b. Change Oil. |
| 14 | | | | | | | PARKING BRAKE |
| | | | | | 1000 | | Check adjustment. |

By Order of the Secretary of the Army:

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Distribution:

To be distributed in accordance with DA Form 12-25B, Organizational maintenance requirements for Earth Moving Equipment Loaders.

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